

[Author Fred Gamst's note to the reader:

The following MS. results from industrial and organizational ethnological field research on the Southern Pacific system from 1978 through 1988 (eleven years). (Anthropologists do not think they understand a social system after just a few student trips with a craft.) This MS., now out of print, was published as:

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In classic timetable and train-order territory, the study focuses on several dimensions of train dispatchers' work, viewed through the other end of the telescope, i.e., from the perspective of the dispatched train crewmembers and others in the field. The monograph, comprising a microethnographic case study, emphasizes the cognitive worktasks--including mental manipulations of changing information, logic of procedures, work interactions, and language used--on just one freight train trip. Railroaders' integrations and applications of circumstantially selected sets of operating rules for the movement of trains control the freight trip. More broadly, the study constitutes a railroad apprentice's instruction for and a layman's introduction to North American railroad operating work. Specifically, a demonstration of the safety-critical nature of the corpus of interrelated railroad operating rules provides the underlying framework of the case study.

Fundamentally, A main track must not be occupied or fouled without authority, except under protection. . . . But, in the rail world, what are the myriad possibilities of this rules foundation? Read on.

The photos in the MS., unnecessary for an understanding of the study, could not be reproduced but their captions are included. The timetable for the Santa Barbara Subdivision of the Southern Pacific Transportation Company (Pacific Lines), which would be helpful, is also not reproduced. The full text of the study, below, includes the body of all train orders and other on-paper directives from the train dispatcher. F.C.G. fcgamst@aol.com]

HIGHBALLING WITH FLIMSIES: WORKING UNDER TRAIN ORDERS

ON THE ESPEE'S COAST LINE

by Frederick C. Gamst [1990]

INTRODUCTION

This monograph in the form of a case study is of interest to the reader in two ways. First, the study deals with the ordinary, day-to-day work of operating and related railroaders who use the method of rail traffic control by timetable and train order. These railroaders are those affected by the movement of trains and engines. Second, this essay deals with railroad workers by focusing upon their mental/cognitive--rather than manual--concerns, skills, worktasks, responsibilities, and demands of the job. I know of no such monographic focus in a study of so-called blue-collar workers of a large industry.

The reader will learn about the safety-sensitive mental tasks for which railroaders think at work coherently, systematically, and, above all, logically. In other words, the reader will become acquainted with the ways in which “to railroad” these personnel must plan, reason, infer, analyze, reckon, judge, justify, collectively deliberate, and conclude. The two emphases, everyday railroading and mental aspects of work, are reflected in the title of this monograph. A “highball,” in the slang (that is, argot) of railroaders, is a hand or oral signal for a train or engine to proceed, and “highballing” refers to moving on the track at a brisk rate after being given such a signal. “Flimsies” are written directives from a train dispatcher, ordinarily on flimsy tissue-paper blanks. They provide a basis for the many mental calculations and judgments of the railroaders’ work examined in this monograph. The railroad depot (building from which passenger or freight services are conducted) and wayside worksites of roadway workers are just as much workplaces in this monograph as are the engines of the trains rolling past. (In the present monograph, all railroad slang is shown by “quotation marks” and all technical terms when first explained are indicated by *italics*.)

Throughout this case study, among other things, the reader comprehends something of the work of the operator who mans the depot, in his or her coordination of railroad movements. He or she does this through the materially insubstantial and fragile “flimsies” containing powerful, safety-critical written thoughts--directives for rail traffic control. Nonrailroaders (called “civilians”) often view a railroad depot from the outside and sometimes visited it on the inside. But, just what is occurring when a voice materializes from a loudspeaker mounted over a desk in the depot and booms: “Santa Barbara, west; copy four.” What is the meaning of the seemingly arcane language, with repetitive words, dictated by the disembodied Jovian voice of authority to the depot operator for typing on several blanks interleaved with carbons, for example: “AFTER EXTRA NINETY NINE NINETY EIGHT 9-9-9-8 EAST ARRIVES WALDORF W-A-L-D-O-R-F ENGINE FORTY TWO FIFTEEN 4-2-1-5 RUN EXTRA WALDORF W-A-L-D-O-R-F TO HADLEY H-A-D-L-E-Y / EXTRA FORTY TWO FIFTEEN 4-2-1-5 WEST HAS RIGHT OVER NINTH N-I-N-T-H, EIGHT THIRTY TWO 8-3-2 ENGINE THIRTY SEVEN NAUGHT NINE 3-7-0-9 WALDORF W-A-L-D-O-R-F TO HADLEY H-A-D-L-E-Y.” Why did the operator previously throw a lever or else an electric switch causing the train order signal on the mast outside of the depot to display a red aspect? But, if this all-important signal displayed red, why did a subsequently approaching freight train pass it without even a pretense of stopping? Can a red railroad signal mean something other than “stop”? (See Gamst 1975 for the evolution of color codes and indications in railroad signaling.) And what were those small bundles of sheets of paper for which crewmembers on the moving train leaned out and snagged, after these had been strung by the operator with cord across a Y-shaped track-side device? (See Fig. 14 for snagging of train orders.)

The Southern Pacific Transportation Company, or Espee, whose operations by timetable and train (T and TO)

order are used in this report, provides models, par excellence, of railroad work under train orders and other written directives. For a focal point of the Espee's T and TO operations, its Coast Line (see Fig. 1), comprising parts of the Los Angeles and the Western Divisions, is depicted to provide a wide range of working under train orders. Although T and TO operations become increasingly rare, the explained cognitive tasks of railroaders continue, in various ways, in their use of the operating rules under other modes of rail traffic control.

As one who has studied and used train orders for the past thirty-five years, since 1955, I have always found those of the Espee to be exemplary in their comprehensiveness and precision of coverage for safe and efficient rail traffic control. The orders are well explained and defined as regulations in the SP rule book containing them. I am not the only rules specialist with this high opinion of the Espee's rules for rail traffic control, especially train orders. Peter Josserand's fifth edition of The Rights of Trains was once the Bible of discussion concerning the rules and procedures of rail traffic control, and centering on T and TO operations. For his principal explanations, Josserand does not use the rules of his own Western Pacific (Espee: "the Wobbly" and "the Wooden-Axle"), on which he was for decades a train dispatcher. Instead, he uses those of the WP's rival carrier, the Espee. When, in 1985, the General Code of Operating Rules replaced the individual rule books on most of the western carriers, the 36 pages containing the directives and explanations of the forms and examples of train orders were adapted with only slight changes from the same presentation in the previous rule book of the Espee. This Southern Pacific book of rules, incidentally, effective October 31, 1976 and revised several times thereafter was the one in force during the time of the present case study, in June of 1978. On the Coast Line, the Espee ended T and TO operations in 1985, but continued them elsewhere after that date, through 1989.

In all, this monograph directs the reader to what was, until recently, the most basic of about six modes of rail traffic control. Operations (a railroad's business processes and human actions for moving its rolling equipment) by the mode of timetable and train order is the concern of this monograph. Beyond specific T and TO activities, the monograph gives insight into railroad operations in general, because many of the rules used in train-order territory are necessarily used outside of T and TO territory.

An introduction to the language of railroaders begins this monograph. The following section contains some of the method of research for this monograph. Then, in the next section, the reader receives a broad overview of the monograph's subject of mental/cognitive work. In the next section, the reader enters the handsome, bustling depot at San Luis Obispo for an introduction to the "rail" world at that station. The reader also receives a brief depiction of the characteristics of the district over which our illustrative, microethnographic freight trip of about nine hours was made. The following section discusses the historical development and the work functions of T and TO movements of rail traffic. Next, the reader is treated and instructed as an apprentice railroader on the Coast Line, by an explanation of some of the knowledge needed for working by reasoning on that territory. After this, a section explains some of the work of the train dispatcher in the central office and his/her operators in the field manning their depots. As a point of departure for the explanation of mental skills with use of operating rules relating to T and TO work, subsequent sections give an account of a trip on First 832, a freight train carrying, all-important, green signals. The final section,

gives a brief retrospection on T and TO movements and their demands of reasoning upon railroaders at work.

THE LANGUAGE OF RAILROAD CULTURE

In their socialization, railroaders learn their native occupational jargon, or argot, including all manner of basic concepts essential for work and safety. For example, a "territory" is a route or part of a route operated under the authority of a particular mode of rail traffic control. The gradually learned jargon of railroaders, or "rails," allows exchange of technical information rapidly and precisely in their tersely effective language of the rail world.

Rail jargon seems to be of three general overlapping kinds. First, are originally purely technological or organizational terms native to the railroad industry and its culture. Examples include: "marker" (a rear-end signal device, with which a "light," solitary, engine becomes a "train" and without which an engine is not a "train"), "Consolidation" (a "2-8-0" steam engine), "Fresno Mallet" (a 2-6-0, but only on the Espee), "Rule G," "penalty application" of the air brakes, "carman," "subdivision" of a railroad, and "division" of the "BLE." Second, is jargon created by "rails" such as "1. whiskers" (seniority), "2. whiskers" (company officer), "1. board" (a "fixed signal," defined in the argot humor as "a signal that has been repaired"), "2. board" (rotating assignment list), "car toad/knocker" (carman), "air test" 1. to test the airbrakes of a train, 2. for alcoholic breath, in violation of Rule G, and "to big hole/plug it" (to make an emergency air brake "reduction" by opening up the biggest exhaust port in the automatic brake valve). Third, are ad hoc or idiosyncratic uses based on the grammar and vocabulary of rail jargon, such as "I had my teeth rebrassed" (I went to the dentist to have fillings put in my teeth), or "Do that again and I'll set you out" (as we would set out a "bad order," defective, car).

A hand sign may be used in place of a spoken word: stroking one's chin, slowly, means "whiskers" (a railroad officer) in the vicinity. Rails' lingo can be straightforward or humorous. Thus the jargon parody of the "Standard Code's" definition of a "yard" is: "a system of rust inhabited by dumb natives who will not let trains in or out." My fellow Los Angeles & Salt Lakers said these natives were Oregon-Short-Line-types at North Yard in Salt Lake City. Railroaders may also diffuse jargon as chalked words on the sides of freight cars. A chief culprit here is the railroaders' collective alter ego, "Bozo Texino."

Additionally, rail lingo may be, at least, of three ranges of use in space and time. The first is jargon universally used or nearly so, such as "caboose" and "locomotive [not railroad or train] engineer." Misuse of words is a distinguishing characteristic of the "civilian" or outsider, who, for example, talks about "driving" a train. The second could be jargon broadly regional, such as the trio of separate regionalisms: to "dog catch," "patch," or "hog catch" a train crew (to relieve them from duty as provided by the federal "Hours of Service Act of 1908, as amended," i.e., by the "dog-catch law" or "hog law"). The second could also be more narrowly local such as: "the Pedro main" (what OSLers--busy Wabashing, sideswiping, cars in the North Yard--called our "property" as they looked, longingly, we were sure, toward the golden "timetable west," actually compass southwesterly).

The third, spanning types 1 or 2, is jargon historically used but now defunct. Examples include: "wooding up" (to

load a tender with split-wood fuel), "jerk water" (to pull a water spout down from a water tank and fill a tender with water), and "showing green" (a fixed signal or "fusee," flare, with this "aspect" of the color code "indicating" caution/approach, before 1904, when the proceed /safety color was "clear" or white). Remainders of this third type could linger on, however, for example, in "jerk-water town" and "tank town." Today, we often call the proceed signal as "clear" even though it shines green. Now largely defunct are: "30," the end of a telegraphic message or order from the "delayer," train dispatcher, to one of his "lightning slingers," telegrapher operators, recording "flimsies," train orders on tissue blanks, in their "op fist," stylized handwriting of these operators. Journalists still use "30" to mean the end of their submitted copy for an article. (For more on the social boundary- maintaining and efficiently communicative jargon, or specialized language, of the "rails," see Gamst 1980b:3, 137-142.)

Fig. 1. Map of the Southern Pacific's Coast Line

METHOD OF RAILROAD RESEARCH

This monograph is a product of the social science of ethnology (social and cultural anthropology), which since the 1930s, has a well-developed specialization in contemporary American and Canadian modern organizations, industry, work, and occupation (Gamst 1989a, 1990a). Ethnography is the factual reporting, including the case study, aspect of ethnology. It delves narrowly and profoundly into aspects of a society and its culture (its socially learned way of life including social relations). (Germane to this case study, for discussions of industrial and organizational ethnological methods and goals of research see Gamst 1977, 1980a, and 1984, and for discussions of the social scientific concepts of culture and society see Gamst and Norbeck 1976.)

Background information for this monograph on railroad work comes, over the past thirty-five years--since May 1955-- of my association with the railroad industry, from discussions with railroad employees of all kinds, participant observation on and off the job, formal interviews, survey research with questionnaires, focus group discussions, analyses of railroad operating documents, library and archival research into primary and secondary documents on operations and labor relations, and review of published scholarly literature on the industry and its work. All of these research techniques have been used on the Espee and on other railroads. First-hand contact with the railroad work on the Espee also began in May 1955, although as the employee of a rival carrier, with operations over shared main tracks and into interchange yards. Specific information for this monograph comes from hundreds of days of structured ethnological research on the Southern Pacific, since 1978: on engines and cabooses; in depots, interlocking towers, train dispatchers' offices, crew dispatchers' offices, and crew register rooms; in engine and car shops; with small and large track gangs; and in yard and other offices, layover facilities, and other sites of railroading on the carrier and its subsidiary railroads. For each field trip on a train, I requested of the engineer or conductor, and subsequently received, the train orders, messages, and other operating documents from his following five round-trip runs; hence, usually ten complete trips in all. Such fulfilled requests enabled me to study a much broader range of variation of the field trip in which I had participated with this crewmember. For many of these crewmembers, I followed up with

correspondence, telephone conversations, and face-to-face discussions on subsequent occasions. This field research extended from San Francisco: to Dunsmuir and Eureka, California; to Ogden, Utah; through Kansas City to Chicago; to Pine Bluff, Arkansas; and to Avondale, Louisiana. A large amount of research was conducted on the Coast Line, from Los Angeles to San Francisco and Oakland during 1978 through 1987 and additionally included three summers and other time among railroaders in and around the terminal town of San Luis Obispo, California.

The central part of this monograph is an exemplifying microethnography, case study which comes from one field trip of about nine hours on a freight train while under the tutelage of a veteran locomotive engineer, forty years on the job. This detailed and precise microethnography depicts railroad work from the usual perspective of the ethnologist, from that of the insider--in this case, the railroad operating and related employee. Besides depicting the mentally complex and demanding world of work of such railroaders, this monograph is a methodological exposition of what highly intensive industrial and organizational ethnology can produce from a brief field research trip of an ethnologist with a specialization in a particular kind of large organization. (Often an ethnological project of field research into a novel, instead of a familiar, setting could take a year or more, however, as, for example, my study of the previously unreported Qemant people of Ethiopia [Gamst 1969].) Although I have taken thousands of photos and slides along and on the Espee since 1956, the illustrations in the monograph come mainly from the central trip discussed in the following sections.

For the work depicted on the Coast Line, all circumstances, designations, and conditions, including the railroad operations and rules and practices governing them, are depicted for one period of American railroading, during June 1978, and are not entirely those obtaining at other times. Of course, the sole authority for interpretation of rules and practices as applied to railroad operations are the operating officers of a carrier, and especially the manager of rules (or chief rules examiner) and the vice president of operations. For the sake of safety, the final statement on the interpretation of the operating rules of any carrier must necessarily reside with the highest ranked officer responsible for these regulations. I am grateful to the officers and other employees of the Southern Pacific for their considerable assistance with my research leading to this monograph. In particular, I want to express my gratitude to Robert S. Bogason of the Southern Pacific's Law Department for his support in my researches on "the property" and for the stimulation from our discussions across a decade concerning the web of operating and work rules in railroading and the nature of railroad work and labor relations in general. And I wish to express my heartfelt appreciation to locomotive engineers Lee Barnett, James McEntire, and Roe Bradshaw for their formative tutelage on the three segments of my first set of "student trips" down the Coast in June of 1978 and for their continued instruction and assistance since that time. Numerous other active and retired union and management employees of the Coast have provided me with guiding tutoring on the job and informative discussions off the job. Finally, I thank general officers Robert Krebs, William Lacy, and Charles Babers for the permissions and courtesies they granted me in my wide-ranging field research across their "property."

This case study is dedicated to the men and women of the Southern Pacific, of all positions, who are or were employed on the Coast Line. Interpretations and generalizations in this monograph are my own and not necessarily those of any other person or organization. My wife, Marilou, helped me with the research for and word processed this

monograph.

OPERATING AND RELATED EMPLOYEES AND THE MENTAL/COGNITIVE ASPECTS OF THEIR WORK

Railroad operating jobs are those of on-train and on-engine employees who man movements of these two kinds. Included with the operating employees in this study are several kinds of nonoperating employees directly connected with the movement of trains and engines, over the road and in terminal areas. All of these railroad employees involved with the movement of trains and engines call themselves “rails” and the term is used in this monograph to describe them. Nonoperating employees are those who provide mechanical, engineering, clerical, and other support to the operating employees (in depots, roundhouses, car shops, offices, along the track, and so forth). Operating occupations with which we will be concerned in this monograph are those of brakeman, conductor, locomotive engineer, locomotive fireman, and switchman. The directly connected employees are yardmaster, crew dispatcher, chief train dispatcher, train dispatcher, and (telegraph) operator. The first four make up the crew of a freight or passenger train and the last two provide rail traffic control for movement of trains.

On-train employees, because of the highly mobile and wide-spread operations of railroading, cannot be directly supervised in their work by operating officers, save for periodic spot checks in the field, occasional ride checks on board, and after-completion-of-trip monitoring of performance. Work for the “rails,” then, requires a keen sense of responsibility and a marked capacity for error-free, logical thinking not found for workers in most other industries. Much of the T and TO work requires a variety of inductive logic in which the railroaders reason, from a number of specific known interrelated rules and operational circumstances regarding a particular instance on their job, to a general conclusion: “All of these things considered, we do not have time to make the next station to meet No. 13.” Often the work is logically deductive where they reason, from a known general principle, to a specific conclusion: “Given that we must have either authority or protection to occupy the main track with these cars, and the former expires 5 minutes from now, you’d better start walking down the line to provide the latter.” As we shall see, the mental problem solving in operating and connected work ranges from simple to intrinsically complicated. Proper performance of operating jobs means danger-free and efficient completion of work using appropriate cognitive and perceptual-motor skills. Cognition is a general term covering all forms of knowing, including perception, judgment, thinking, remembering, and planning for the future. It also includes the results of these forms of knowing. Cognitive, or mental, skills such as those of “rails” emphasized in this monograph, are the abilities--from training or practice or both of these--required to know when, where, and how an action must be performed. Such acts may include related perceptual motor skills. These are the actions required to make a response to a stimulus. Railroaders’ work involving the handling of trains, switching of cars, and reactions to indications of myriad kinds of signals will be only barely mentioned in this monograph, to devote our attention more fully to the range of variation of mental skills used in rail traffic control for the movement of trains. (For more on all the worktasks of “rails” see Cottrell 1940 and Gamst 1980b.)

What the reader will learn in this monograph is how operating and operationally connected railroaders working on territory such as that explained in the following sections have one of the (if not the) most mentally demanding jobs of any industrial workers—including air traffic controllers and commercial aviators. The literature on industrial social science is replete with discussion of “blue-collar occupations” and has considerable attention given to the high-skill manual workers, usually labeled as “craftsmen.” For example, relevant to this monograph, industrial sociologist Theodore Caplow explains that, “Skilled Manual Workers: Are those such as . . . locomotive engineers, printers . . .” (Caplow 1964 :36). Another noted industrial sociologist says on the subject of skilled workers who are blue-collar craftsmen, “These occupations engage in manual, rather than mental, work and dirty, as opposed to clean work” (Hall 1975:187). In this vein, Richard Hall expands, that the crafts possess scarce skills, including, for example those of the “railroad engineer” (1975:188; 1986:67-69). Further, between the crafts and the professions, “The basic difference is that the professions stress mental prowess, while the crafts stress manual dexterity” (Hall 1975:196). Certainly, “rails” often get their hands and clothing dirty in railroading because train equipment tends to be coated with grime and dust. The view taken in this monograph, however, stands traditional social scientific perspective on its head. The highly skilled “blue-collar” operatives that we discuss in this case study, the “rails,” engage in demanding work calling for intensive mental prowess. The railroader adjusts to new circumstances and problems at work by means of analytic abilities of the intellect which allow for acting in situations not previously experienced and in which no supervisor is present. The necessary common understanding of operations carried by all railroaders is provided by their socialization to the rules. Work for the “rails” is safety critical and involves mental tasks for the mastering of train movements which are potentially catastrophic, but which are rarely disastrous because of the proper exercise of these intellectual abilities. For some of the rare examples of the catastrophic missuses of T and TO work, see the reports of the National Transportation Safety Board listed in the references section, for the years 1975 through 1990.

DOWN AT THE DEPOT IN SAN LUIS OBISPO

A truly splendid, radiant June morning enveloped me. It was a quiet, lazy Sunday. The humming town, which I entered the previous evening on a lumber train originating in the redwoods of Eureka on the Espee's Northwestern Pacific, was now still. With my worn, grimy, laden trip grip pulling my arm out of its socket, I reported to the sun-drenched depot at the Southern Pacific station of San Luis Obispo, California (SLO). The exquisite day must have been the kind the Massachusetts poet James Russell Lowell had in mind when he wrote his familiar lines, “And what is so rare as a day in June?/ Then, if ever, come perfect days....” But Massachusetts is not the Golden State's Central Coast where almost every day is unarguably poetically glorious. Lowell was climatologically deprived, I mused. With justice, the local railroaders call the SLO region, “God's Country.” The day was indeed heavenly.

Located in the middle of the Coast Line, the picturesque “San Luis” depot had several palms and a now-unused water tank in the background, across the double main track running parallel to its two ground-level passenger platforms. Along the double track about a half mile to the east of the depot, past the stucco building of the former Railway Express Agency and, then, a wooden frame freight house, was the roundhouse area. The demi-roundhouse no longer stood but a few of the tracks and the concrete floor of its stalls radiating from the turntable were still extant and sometimes stored an engine. Here, on the massive steel turntable rotating in a concrete-lined pit, the roundhouse

foreman was “turning” a venerable SD-9 diesel-electric locomotive weighing some 190 tons; one of the units that aided in the retirement of the carrier’s steam engines in the 1950s. After servicing, the six-axle SD-9 the foreman added it to the consist of a 4-unit helper engine, he coupled together on an adjacent outbound lead track. The helper and its crew of an engineer and assisting fireman would be called later in the morning by the SLO crew dispatcher, to push a westbound train out of the five-track yard and up the steep and tortuous Cuesta grade of the Santa Lucia Mountains of the Coast Range. (Crew dispatchers handle the operating employees' assignments and are a distinct craft for train dispatchers.) Looming to the west, Cuesta hill overlooks the university and once-important railroad town of San Luis Obispo. About 1000 railroaders worked in SLO at the height of the World War II traffic. Replacing an older wooden frame building, the Espee completed SLO's striking depot during 1943 in the general style of California mission revival. The dominant architectural theme, then, is a simplified version of Spanish Colonial; this is modified by some touches of the streamlined Art Deco style of the late 1930s. The result was a magnificent architectural gem of one Espee model of depot. (In 1987, the SLO depot was extensively renovated and refurbished. Today the depot is a well-burnished jewel, used by Amtrak.)

In the crew dispatcher’s office of the bustling depot, I sipped a cup of coffee given to me by the friendly clerk “calling crews” that Sunday morning. As customary, one wall of this office was of glass allowing the reading by railroaders from the facing hallway of the numerous, small, color-coded “blocks,” displaying their names and arranged in vertical groupings under headings for the various train and engine assignments out of and around SLO. While I studied the “boards,” as these wall-mounted vertical arrangements of blocks are called, I wondered: over the decades how many railroaders stood here, calculating when they might be called and, occasionally, “sharp shooting”-- analyzing whether it would be beneficial to “mark up” for assignment for a particular advantageous position in the rank order of a “board.”

The first cup was gratis, but in subsequent research out of San Luis Obispo, over the following decade, I had to join the depot coffee pool. Sipping coffee and “old heading it,” I waited for the train of highway trailers and containers on flat cars and of tri-level-rack cars carrying new autos that I would take on a familiarization road trip down “the Coast.” Along with the crew, I had received my call from the local crew dispatcher to come on duty at 9:30 A. M. With a number of operating employees and officers, I discussed the route ahead. Its terminus was Los Angeles Yard, 217.5 route miles to the south of the depot, by compass heading, but to the east of us by timetable designation. Except for a few miles of line around the San Luis Obispo and Santa Barbara stations, the route was all single track until the ten or so miles of double track between the Burbank Jct. and Los Angeles Yard stations. Single track is a main track on which trains operate in both directions. Most of the route-miles of North American railroads are single main track. Double track is a variety of two main tracks, on one of which the current of traffic is in a specified direction, and on the other in the opposite direction. Apart from the three short segments of double track, the route ahead of us was T and TO territory. In this year of 1978, the Espee operated several segments of its lines under the T and TO rules discussed in the present monograph. Transcontinental in length, if stretched out in a straight east to west route, the carrier extended some 3220 miles from Avondale terminal on the Mississippi, across from New Orleans, to Brooklyn terminal, at Portland, Oregon, on the Columbia.

In the morning cool of the San Luis depot, inside the large room the railroaders still called “the telegraph office,” the operator on duty had already received from the train dispatcher the words and numbers in the clearance and train orders for our approaching train. It was then finishing its descending of the snaking, tunnel-studded 2.2 percent ruling grade of Cuesta, with a deep whining from the fully generating dynamic brakes on the engine and a slight wisp of whitish smoke along the train from the applied brake shoes on the trailing loaded flat and rack cars, each 89 feet long. The operator, who is a special kind of clerk connected with railroad operations, is sometimes called a telegraph operator, although nowadays he communicates by telephone and microwave radio. At times, this employee is referred to, with apt description, as a train-order operator. When in a tower or depot from which he controls wayside absolute signals directing the movement of rail traffic, he is labeled a control operator. As the railroaders call this depot office over the radio, the “BI telegraph,” still uses the two former telegraphic call letters for the San Luis Obispo station. Contained in the office are: metal racks of radio equipment; a computer and printer desk for clerks’ tasks regarding lineups of inbound and outbound trains and the consists of these, consignment of cars to area shippers, and other matters; and an operator’s desk. This contained the radio to trains on the road and the radio and telephone links to the train dispatcher, blank forms for train orders and clearances, and other materials for the rail traffic control in which the operator participates with the dispatcher. Essential for the reporting of the departure of trains from the station are the windows of the exterior office wall. Cutting in to the interior wall from the hallway is an alcove with a standard clock for the checking of watches by train crewmembers, books of timetable bulletins and of division notices, and a train register book.

Through the window into the alcove, the operator handed our conductor and engineer their written orders. After reviewing and discussing the latest bulletins and notices, our conductor and engineer studied the flimsy tissue-paper orders before handing them to our two brakemen for their reading. Our two duplicate sets of clearance form and train orders are addressed “To C&E” Thus, the conductor, who is in charge of the train according to Rule 843 of the 1976 SP book of operating rules (hence, BOR 843), and the locomotive engineer, who operates (“runs”) the engine and controls (“handles”) its trailing cars, each get a complete set for their own use. Every set is shared with the other crewmembers. Ordinarily, in freight service these are the head (front) brakeman on the engine and the rear brakeman who shares the caboose, at the rear end of the train, with the conductor. Sometimes a locomotive fireman is on the engine, as an assistant engineer. On and off the caboose, the conductor does required paper work, communicates by radio and hand signals with off-train employees, monitors the progress and security of his or her train, checks and reinforces the observance of train orders and operating rules by the engineer, and supervises and participates in the switching of cars and the correction of mechanical defects on cars. After reading the orders and the clearance, our conductor registered our train into the train register book and, then, filled out a register check form, recording any trains superior to us that had already departed San Luis on that day.

Taking my well-thumbed SP book of rules out of my grip, I read from the thirteen lines of instruction of BOR 843, “government of a train is vested in the conductor, except when there is a pilot in charge.” This is the central rule for the command of a train or yard engine, and in effect on American railroads since the late 1830s. A pilot is an operating employee assigned to a train when an engineer or conductor is unacquainted with either the rules for or

physical characteristics of a part of the railroad over which the train will move. In such cases the operator must add by hand "and Pilot" to the clearance form after printed address "To C&E." A conductor and engineer cannot take off with their train willy-nilly on a district if one of them has little or no knowledge of either the complex interrelated operating rules and procedures pertaining to it or the characteristics of track, wayside signals, and route. An engineer or conductor cannot simply "get on" a train "and go." To do so would result in operational hazard and ultimate accident.

From my bulging grip, I next pulled my operating timetable, also called "employees' timetable," and reviewed the schedule page for our route (see Fig. 2). I could see that a small amount of the route to be traversed was, combined, "Rule-D-97 territory and Rule-D-251 territory," railroaders' labels for the double track ahead governed by those two fundamental operating rules. On Rule-D-97 double track, as authorized by operating timetable, engines moving with the current of traffic are allowed to run as extra trains without train-order authority. Such authorization is received from Los Angeles Division Timetable No. 10, Effective April 30, 1978, Special Instructions, Santa Barbara Subdivision, page 33. (In the present monograph, this 77-page operating timetable in effect during our field trip, will be referred to as "LADT." Note: Rule numbers with the prefix S pertain to single track only and with a D to double track only.) This timetable contains 60 pages of operating rules coded to and supplementing the book of rules, for the Los Angeles Division, and labeled "Special Instructions."

Fig. 2. Timetable page for the subdivision governing the illustrative run on the train First-832. Abbreviations on such pages are: s-regular stop, TO-train-order office, R-train-register station, B-bulletin station, K-standard clock, I-interlocking, Y-turning facility, P-telephone [to dispatcher], Q-base radio station, E-eastward siding, W-westward siding, DT-double track limits; siding length in feet is shown as a four digit number, e. g., 1782.

HISTORICAL DEVELOPMENT AND FUNCTION OF T AND TO OPERATIONS

While in the cool, high-ceilinged San Luis depot, I began the first of many conversations I participated in over the next ten years on my research into railroad operations, especially concerning rail traffic control. For the crew dispatcher, operator, and members of the train crew present in the depot that morning, I reviewed my historical library and archival research concerning the development and the functions of the T and TO operations I would study on their Coast. Accordingly, I related that before the advent of electronic train-order operations, in the mid-1800s on the ubiquitous single track lines, movement of trains was controlled entirely by timetable and beginning-of-trip written train orders. By electronic orders is meant their transmission by, at first, telegraph, subsequently, telephone, and, then, radio. In the pioneering rail traffic control, a positive meeting or passing of trains regardless of the amount of falling behind the schedule was required by operating rule. (For the purposes of this monograph, the pioneering period of rail traffic control in America is before the Civil War.) In accordance with the timetable-only operations of the period, a train was required to wait at a station where a meet with another train was shown in the classified schedule of the timetable. (For example, in Fig. 2, by the convention of **bold** type used to indicate a meet between trains, this recent

classified schedule shows train No. 13 meets No. 832 at Ortega at **12:04 P.M.** and No. 12 at Oceano at **2:10 P.M.**) In the pioneering past, a train waited until an expected train arrived or was otherwise heard from. If one train had a mechanical failure, derailment, or other serious delay, many trains could be waiting hours for it at scheduled meeting or passing stations. The only alternative was for a waiting train to send a flagman, usually a brakeman but sometimes the fireman, walking about a mile ahead of its movement, for flag protection against the overdue superior train. In pioneering times, daily written train orders issued at the beginning of a trip supplemented operating timetables. Such traffic control engendered safety in railroad movements but, alone, was highly inflexible. Even without a serious delay, minor setbacks would constantly retard a freight train in the course of its movement away from the initial terminal, when running between stations and switching cars en route (cf. Gerstner 1842,1:291-295).

The development of a commercially successful electric telegraph by Samuel Morse in the 1840s made possible a flexible adjunct to traffic control by inflexible timetable and initial train order-- train orders telegraphically transmitted to wayside stations. Such regulation of movement of trains obviated the progress at a crawl, actually the pace of a walking flagman, of an inferior train against the overdue schedule of a superior train. In 1851, a superintendent of the Erie Railroad traveling on a train waiting for an opposing superior train created the first operations by electronic train-order. He telegraphed to the next open station (one with a telegraph operator on duty) ahead: "To Operator at Goshen: Hold eastbound train till further orders. Charles Minot, Superintendent." Next, he wrote an order for the conductor of his own train: "To Conductor Stewart: Run to Goshen regardless of opposing [timetable scheduled] train. Charles Minot, Superintendent." With this innovation, railroads could now combine flexibility with speed in the safe movement of trains (cf. Dalby 1904:7-8; NY&E 1857: 6-20). During the 1850s, telegraphic train orders were gradually adapted by other railroads, and their use grew apace after the Civil War (Gamst 1990b).

In 1886 and 1887, a predecessor of the Association of American Railroads (AAR), the General Time Convention (GTC 1886), developed a "Code of General and Train [Operating] Rules." These rules are the precursors of the AAR's The Standard Code of Operating Rules (AAR 1980), from which the rules of each railroad are derived. The 1886 code did not specifically deal with telegraphic train orders, but its Rule 111 significantly stipulated: "All messages or orders respecting the movement of trains or the condition of track or bridges must be in writing" (ARA 1893:50-55). This rule generally accords with 1976 SP Rule 101-A. During 1887, the Convention codified its "Rules for Movement of Trains by Telegraphic Order." Stipulations and even the wording of these rules are substantially the same as current AAR Code Rules 201-223, on train-order operations (ARA 1893:125-132).

An essential principle of rail operations from Superintendent Minot's day to the present is the very basis of train-order movement. This principle is that train orders must be used in written and not oral form. As the noted specialist on operating rules, Peter Josserand, explains, "memory is tricky; and MUST NOT be depended upon . . ." (1957:397). SP Rule 202 requires that, "Each train order must be given in the same words to all employees or trains addressed." BOR 201 also requires, "They must be brief and clear; in the prescribed forms when applicable; and without erasure, alteration or interlineation." Such long-standard procedure prevents the possibility of lap orders, (that is, lapse of authority train orders) wherein two opposing trains, or one overtaking another, receive conflicting train orders to occupy the same stretch of main track at the same time. The uniform safety of issuing train orders in the same words to all

addressed was developed after the Civil War when the single order system was replaced by the duplicate order system of train dispatching. In the earlier system, single individually (differently) worded orders were given to each train concerned with a particular movement, such as a (head-on) meet of two trains on single track. In the later system, the order given to each concerned train is an exact duplicate of that given to every other such train. Thus, only one exactly-the-same directive is interpreted and acted upon by train crews concerned, and numerous chances for error are obviated (cf. Turner 1885:13-17; Anderson 1891:8-9). The written train order (and other kinds of written directives for the movement of trains) provides a high level of operational safety on lines not having a mode of rail traffic control such as double track, interlocking signals, Centralized Traffic Control, or Direct Traffic Control.

Incidentally, when a train is between train-order stations where radio contact can be established, the operating rules provide for the transmission of train orders “via radio” to a crewmember of the train, with all of the safeguards of those sent through an operator in a depot. Such transmission, by contractual work rule, requires particular penalty payments to the train crewmembers involved and to the clerk qualified as an operator who is “first out,” waiting assignment, on the clerks’ extra board. Consideration of railroad work rules, even as they interrelate to operating rules, is part of the fascinating study of industrial relations for the industry. To provide a tight focus and relatively short compass for the present case study, the subject of work rules must remain outside of its scope. For a comprehensive and instructive single-volume introduction to this stimulating, cerebral part of the railroad web of rules, about which all railroaders are familiar, read Harry Lustgarten’s *Principles of Railroad and Airline Law*.

APPRENTICE BACKGROUND FOR T AND TO OPERATIONS

To understand the mental and other T and TO work of railroaders requires some basic instruction on the subject. The present section, accordingly, treats the reader as an apprentice railroader. It thereby provides the minimum essential background information, first, on railroading under the rules in general, then, on using the rules regarding rail traffic control, and, finally, on related work in T and TO operations. The selected apprentice instruction partially socializes the reader to the mental/cognitive work of the “rail” world and the rules governing it. On the railroad, “The ‘rules’ are the all-consuming focus of the attention of the apprentice” (Gamst 1989b:65). In the subsequent sections, through the selective apprenticeship, the reader is able to profit with comprehending awareness and insight from the freight trip taken that June day and reported in this monograph.

During the reader’s learning, this case study gradually and informatively builds selectively a basic understanding of railroad work. To aid in learning comprehension for a difficult subject, not everything about an operating rule and practice can be presented at once and in one place. Instead, the monograph selectively and cumulatively adds and interconnects explanations building on previous presentations. (This process parallels the learning of tasks by the railroader.) Comprehension is thus reinforced through reexplanation of mental tasks in a later, somewhat different context. The attention of the reader to the apprentice instruction will reward with an appreciation of North American railroading.

To start at the most general level of apprentice instruction, a large number of interrelated operating rules and practices govern rail traffic control and other handling of rolling equipment (cf. Gamst 1983). Long-developed disciplinary procedures enforce a railroad's operating rules (cf. Gamst 1986). North American railroads have their many hundreds of central rules in a book of operating rules for the movement of rolling equipment and related matters. In a separate part of this book, or in related books, are rules concerning air brake, mechanical, and train handling matters, plus rules for safety on the job. Supplemental rules of all these kinds are found in the operating timetable ; these in turn are updated by timetable/special bulletins . Operational circular notices are also issued periodically. The most particularized and immediately applicable operational directives are found in the written clearances , train orders, and operating messages issued to a particular train crew by a train dispatcher, ordinarily through an operator. These last three kinds of directives provide for the exactly stipulated movement of a train on a main track to certain stations at designated times in particular manners and for the passing and meeting of other trains.

This monograph demonstrates that a high level of mental skill is essential to working and to job safety for railroad operating and connected personnel. These railroaders use mental skills in performance of conceptual tasks and involve choices among responses learned previously. As in the other kinds of railroad operating work, such previously learned choices in T and TO work vary in accordance with the interplay of constantly changing events on a run or shift. Thus, choices involving virtually any of the operating rules and regulations in differing combinations are the basis for safety-critical action and reaction by employees. Accordingly, operational work of this kind involves well-informed exercise of judgment. As the reader shall demonstratively learn in his or her study of T and TO operations, unless every train crew member and other employee relating to train movements is well-versed in the complexities of the written rules and regulations, the systematic meshing of operational undertakings can malfunction--at times to the point of danger. (Other employees include roadway workers such as trackmen, bridge and building workers, and signal maintainers.)

The various formats of operating documents concerning rules reviewed in the paragraph before the last are the bases of the not-directly-supervised mental process of information evaluation and decision making used by personnel in railroad work. It is such process and work we will now review for operations by T and TO. Because the numerous interwoven rules are the basis of railroaders' cognition at work, the present instructional section refers to and interrelates many of the salient regulations so that the reader can understand better what enters into "rails'" mental tasks. The book of rules of each carrier, ordinarily codified the rules uniformly. This was true for all North American railroads, through 1985, when the standard code of operating rules of 1893 as amended began to be replaced by several regional codes. Thus in the Reglamento para el Departamento de Transportes of Nicaragua's Ferrocarriles Internacionales de Centro América and in the Reglamento de Transportes of the Ferrocarriles Nacionales de Mexico, Rule 93 concerns yard limits, 99 flag protection, and the rules in the 200-series explain T and TO operations, and so forth--all with the wording and practices noted in this monograph concerning the Espee. In the monograph, rules are cited by standard code number to label and chart the interconnected ways in which the railroaders have their thoughts and acts (and attitudes) directed by their web of rules for work. Citation of rule numbers allows the reader to begin to perceive some of the formal elements of organization of the native railroader's social relations and tasks of work and related viewpoint.

In the apprenticeship of this case study, we begin with the most elemental concepts for cognitive work in North American railroading and, then, proceed to ones that logically build upon these mental basics. According to SP BOR Rule 80, the first rule in the section on "MOVEMENT OF TRAINS": "Main track must not be occupied without authority or protection." When a train, engine, or other rolling equipment occupies or fouls a main track without authority to do so, it must be protected by its crewmembers or qualified others as prescribed by the stipulations of (flag protection) Rules 99 or 99-A, except where flag protection is not required by the rules. The apprentice "rail" soon learns that one does not enter or remain on a main track without authority, and if one does not or no longer has such authority, protection must be provided, immediately.

Although undefined in any formal railroad source, in the informal, on-the-job determinations of agent-railroaders, protection means the preservation from danger according to the rules, of an object from damage or destruction, or of a person from injury or death. Authority is the right under the rules to take action and to make final decisions. The flag protection provided by a flagman with his signal equipment (or by a flag or other signal previously placed by a flagman) is the highest level of authority for the movement of trains and engines. When a flagman (or a placed signal) signals "stop," an engineer running an engine or an employee on the rear car while controlling a backing movement has no choice or discretion. A stop is compulsory before the rolling equipment passes the point of the flagman's (or placed signal's) stop indication: no agent or object can negate this ultimate authority. "Not even the president of the railroad," the apprentice is instructed. The flagman must never leave his post unless directed to do so by proper authority. Thus, the flagman is taught, when protecting an undermined railroad bridge during the most terrible of weather, he might have to remain at this post indefinitely, until relieved or recalled. Under the protection of a flagman, or--if necessary--flagmen, a train can be moved anywhere and when under flag protection be left standing anywhere. Flagging along a main track without authority to occupy it disrupts the usual authority of a dispatcher, however, and can tie a railroad line in knots. Such rail traffic control of trains is done only when absolutely necessary. Flagging equipment consists of a red (stop) flag, red-burning fusees (stop flares), rail-mounted torpedoes (speed-restricting explosive signal caps), a white-light lantern for any night signal given, a portable radio, and, the flagman's hands for any day signal given.

The apprentice learns, any train not having authority to hold the main track by timetable schedule, train order, or other authority must entirely clear the main track by the time required to do so as prescribed by controlling rules, for example BOR 86, 87, and 89. Failing to do so, except where not required, the train must protect itself by having a crew member "go flagging." That is, according to Rule 89, when an inferior train fails to clear an opposing superior train by the time and in the manner required by Rule 86 (within block system limits) or by Rule 87 (outside of block system limits), it must be protected ahead as prescribed by Rule 99 or 99-A. A standing, as opposed to a moving, train need not be so protected in block system limits. Outside of block system limits, inferior trains clear following superior trains as per Rule 87 or be protected (BOR 99). Rule 830 directs: "Trains, engines or cars must not be left on main track without authority and/or protection."

Engines , on main tracks within yard limits, obtain authority by Rule 93 and/or fixed signal indication. (Rule 93 pertains to an engine's use of a main track within such limits, an activity not requiring train-order authority.) Use of a main track by an engine in yard limits is allowed only after the crew complies with Rules 81 or 81-A, which explain the conditions under which a main track may be fouled safely by a movement entering from another track. Yard limits are a stretch of main track between yard-limit boards and designated by timetable, where engines may operate without timetable or train-order authority.

Yard limits must not be confused with the switching limits, also found around yards and terminals. The former are authorized by rail management's unilaterally promulgated operating rules, and the latter are authorized by the work rules of a bilaterally derived collective agreement between management and a labor union, regarding wages, conditions of employment, and grievance procedures for interpretation of the work rules. Switching limits involve the delimiting of jurisdictions for the allocation of rights to perform work, between operating employees having contractually separate road and yard rights of craft seniority, for example, brakemen and road engineers versus switchmen and yard engineers.

Trains obtain authority to occupy a main track by timetable schedule or timetable special instructions, by train order, and by fixed signal indication . (More about schedules and train orders will be given below.) Kinds of traffic control systems by which trains are governed by wayside block signals (having a color light or a mechanical semaphore arm/blade) whose indications of hue or position supersede the superiority of trains include: Centralized Traffic Control (CTC), Rules 760-783; Interlocking , Rules 605-682; Absolute Permissive Block (APB), Rules 740-745; and Rule-D-251 territory , for double track, Rules D-251 through D-254. The first three of these four are essentially the same, I have maintained since 1955, and of late the rules for many railroads reflect this reality. In each of the first three, a central person controls the movement of trains by manipulation of the aspects of wayside absolute/control signals on a stretch of track. On most lines upon which any of these four systems are not present to supersede the superiority of trains, T and TO operations usually obtain. The four systems are modes of rail traffic control other than the T and TO mode and, as on the Coast, may be interspersed at strategic points in a stretch of T and TO territory.

One of two additional modes of rail traffic control, for lines with light traffic, is upon the many branch lines which are designated in the timetable as entirely within yard limits (where train movements do not take place) and are therefore Rule-93 territory . On the Coast, the Lompoc and White Hills Branches out of Surf are examples of lines designated as entirely within yard limits. Here an engine and its cars and caboose do not display a marker and are not cleared by a dispatcher as a train. The second exception is the lines designated in the timetable as Rule-S-240 territory, for movement of trains by staff system. On the Coast, the Ventura branch, out of Ventura Jct. is an example of a staff-controlled line. In such territory, an extra train may operate without train-order authority and without provision of flag protection (provided by a crew-member flagman) in either direction on the condition that the stipulations of relevant rules are followed (BOR S-240, sections (a), (b), and (c); S-242; S-244). Use of a train register book regulates and protects the movement of a train into staff system territory. (Possession by a train crew of an actual solitary, wooden staff as the token of authority for sole movement on a specified stretch of track has not been required in recent years.) Unless it becomes disabled and cannot move, once an extra train registers into staff territory, at a

station marked "R" (meaning train-register station) in the classified schedule of the timetable, no other train may enter the territory until the first train registers out of it. (For the branch lines of the Santa Barbara Subdivision, see Fig. 3.)

Despite the existence of the six, plus other, modes of rail traffic control for superseding the requirements of T and TO operations, in 1978, a good part of the route mileage in North America on main tracks and branch lines was governed by T and TO rules. A T and TO line is also referred to as Rule-S-71 territory. This is because of the underlying rule on superiority of trains governing operations: "S-71. A train is superior to another train by right, class or direction"

Movement of trains could hypothetically be entirely by means of a timetable, of the operating employee's kind. (The other kind is a public timetable available to the traveling public. It has information on times of passenger train stops and pertaining to on-train and depot services for passengers.) An operating timetable is the authority for movement of trains subject to the rules. No train transportation exists without an operating timetable, complete with its special operating rules. The last strictly timetable-schedule operation on the SP system took place through 1976 on its former San Diego and Arizona Eastern subsidiary between Tijuana and Tecate, Mexico. Between these stations, "Regular trains will operate . . . by timetable authority and no train orders will be issued affecting movement of such trains . . ." (SD&AE Timetable No. 92 of October 31, 1976, p. 3, Rule 82-A).

If it were desirable that regular trains always be run on schedule and if it were never necessary to run an additional train, the timetable alone could suffice in road operations, that is, on the main track outside of yard limits. But, regular trains should not always be run on schedule and cannot always maintain their running times, for example, because of late arrival of connecting cars, on-demand switching work for customers en route, or mechanical difficulties with rolling equipment. Also, freight cars often arrive in originating terminals at unpredictable times, after being loaded or unloaded at varied times by customers located on industrial spurs and then collected and hauled to the main yard by engines having variable durations of work. Varying numbers of freight trains, therefore, are run at usually changeable times throughout the morning, afternoon, and night, seven days a week.

For flexible movement of delayed and of additional trains dispatched at varying times, the timetable is supplemented by train orders issued by the authority of and with the initials of the chief train dispatcher for a railroad operating territory. Train orders are written operational directives composed by a train dispatcher, under the supervision of the "chief," and transmitted to a train-order operator. This last employee records these directives in a specified way on a standard printed blank on tissue paper and delivers a copy of the completed blank to the operating personnel addressed in its heading. Train orders provide for movements of a train when not authorized by timetable or other authority and are composed in a number of prescribed forms, that is, standard worded presentations of directives.

Fig. 3. Timetable branch lines and lists of additional stations for the Santa Barbara Subdivision.

Should train orders not be issued to a regular train in T and TO territory, or should these orders become void, the crew operates in accordance with the train's timetable schedule. And, if a train, has no train-order instructions with regard to an opposing or overtaking superior regular train, it clears that train on time in accordance with the timetable schedule for the number (for example, No. 12) of the regular train and with the relevant rules. Operating rules for train orders are based upon the premise that an order conferring right upon an inferior train takes precedence away from a superior train. Certain forms of orders do not pertain to movements of trains but, instead, contain information on conditions of track and of structures such as bridges, speed restrictions, wayside signals coming in or out of service, and potentially hazardous locations and equipment. The SP uses 25 standardized forms--from Form S[ingle track]-A to Form Z (BOR, pp. 89-125).

For apprentice-level comprehension of the cognitively complex and often difficult information explained in the present section, we must review the terms and concepts just used and introduce still other related ones essential to such understanding for any railroader involved with operations. We begin by distinguishing between a train and an engine. An engine is a unit of rolling equipment (having flanged wheels for movement on track) defined by the rules as propelled by any form of energy, or a combination of such units operated from a single control, used in train or yard service. Hence, a unit may be energized by a diesel-electric means, as used exclusively on the Espee, or by an external combustion steam engine, a diesel engine alone, or electricity alone. (These last three means are no longer used on the SP and its subsidiary railroads.) A train is an engine specially designated under the rules--nothing more. A train is an engine, or more than one engine coupled together, with or without cars, displaying a marker. Thus, an engine pulling freight or passenger cars does not necessarily constitute a train in the mind of a railroader. At least an engine and a marker signal device are needed to make a train. A marker is a train-borne signal in the form of a red light or other prescribed device affixed to the rear end of rolling equipment operated as a train. The marker need not be mounted on a caboose: it could be placed on the end of the rearmost car or could be part of the electronic end-of-train-device currently replacing the caboose (cf. Gamst, et al. 1988).

A regular train is rolling equipment, minimally an engine bearing a marker, which assumes and fulfills the timetable schedule of any train number. An engine that is not a train, for example a yard engine, may or may not have cars attached during its activities on the main track, where its crew is governed by Rule 93. Train crews reckon with such governing of the engine, as they also know Rule 93 and its ramifications. In all, a train's single-unit engine may have no cars whatsoever and a 12-unit engine not part of a train could be hauling more than 200 trailing cars weighing over 15,000 tons. Further, an ordinary engine with x number of trailing cars could be running on the main track within yard limits and then, by train order, be dispatched as an extra or a regular train outside of the limits to a distant station. It all depends upon the definition of the situation by the rules, as every apprentice railroader soon learns to comprehend. It is not technological equipment or the techniques for manipulating these that defines railroad operating work, then, but the applications by employees of different combinations from the web rules for their work.

Regular trains are represented on a schedule of a timetable. A schedule is that part of a timetable which

prescribes class, direction, number, and movement for a regular train; for example, first class westward No. 5 via Coast Line stations A through K and, then, via Santa Paula Line stations K through T. Unless a schedule is taken away from a regular train by train order, it keeps its schedule to the end of its run on its district, except if a train order stipulates another station before the normal end station. Also, timetable schedules, unless fulfilled, are in effect for twelve hours after their time at each station (BOR 82). Regular trains may be run in sections. A section is one of two or more, physically separate, regular trains running on the same timetable schedule (for example, all as No. 12) and displaying green train signals or for which such signals are displayed (BOR 85, 95). These train signals are a pair of small green classification lights, one on either side of the front of a locomotive (BOR 20). Each section carries its own marker. Extra trains display white classification lights at the location of the green ones (BOR 20-A). (In the color code for signals before about 1903, green indicated caution--here regarding a following section-- and white indicated proceed--once the extra had passed--all subject to other intertwined rules.)

A station, the student soon learns, is not a railroad building of some sort: it is merely a place designated in a timetable by name. As the apprentice "rail" soon learns, a station could have just a sign, "Ajax," along a stretch of track and no depot or other wayside structure need be present. A few years ago the employee magazine of a giant railroad contained a page with a photo of a train on a track passing a station sign, "Herkimer," and in which no other structure was present on the empty landscape. The caption said, "There is no station at Herkimer." The page was posted without any written comment on the Company's bulletin boards across the country. Because of the railroaders' collectively carried knowledge of the rules, no added written comment was necessary. The comment, instead, screamed out to the informed "rail" viewers in un verbalized communication from one of their many shared consciousnesses of kind.

At its initial station, a regular train is authorized by a clearance form to assume its schedule. A clearance is a printed blank filled out and issued by an operator, usually as directed by a train dispatcher. A clearance is used as a general authorization for the movement of trains. Extra trains are not authorized by a schedule. They may run only when: (1) authorized by train orders, in accordance with BOR 97; or (2) after receipt of a clearance form authorized by double-track Rule D-97, in BOR and Special Instructions of timetable; or (3) by signal indication in CTC, APB, and Interlocking territories. In these last three kinds of territories for rail traffic control, a dispatcher or control operator operates and supervises from a central location track switches and particular wayside control signals whose indications of color light or semaphore arm supersede the superiority of trains.

From the day of the first trip the apprentice realizes, regular trains of various classes, both singly and as one of two or more sections, and extra trains ply T and TO territory. First class trains are ordinarily passenger trains or else certain fast freights run on "tight" schedules. Second and third class trains are through freights of all speeds and tonnages, and third and fourth class trains are usually local/way freights that set out and pick up cars on main and branch lines. Extra trains are through and local freights of all kinds and, occasionally, a special passenger train. In S-71 territory, work extras are trains authorized by a Form H train order. These trains are engaged in either railroad maintenance and construction activities or in the switching of freight cars. Their movement may be in either direction

under train-order-specified limits of time and space, which give the crew of a work extra special rights to occupy main track.

Much of the inference by railroaders of their authority to occupy the main track concerns the superiority of trains (precedence of one train over another), which may be by right (conferred only by train order), by class, and by direction (both conferred by timetable). Right is precedence conferred on the SP by train order Forms S-C, D, G (Example 6) or H (Example 12) and is superior to class or direction. Direction (timetable designated east or west) is superior between regular trains of the same class, but not between extra trains, which have no class. All regular trains are classified on the schedules of a timetable with regard to priority of authority to occupy the main track. Trains of the first class are thus superior to trains of the second class and all lesser classes, second class trains to third class, and so on. All extra trains are inferior to all regular trains of whatever class. Preceding sections of a particular schedule are superior to succeeding ones; hence, Second 12 is superior to Third 12. The terms passenger and freight are descriptive of the transport service provided to the customer and do not refer to class or other superiority of trains. Various forms of train orders used analytically by "rails" for safe completion of their work are examined elsewhere in this monograph.

Logically, not being listed in the timetable, no superiority exists between extra trains by (timetable- conferred) class or direction, but only by right, provided by train order. In T and TO territory, the crewmembers of an extra train cannot know where another extra is (it is not listed in the timetable), or be protected from it in normal operations, on their run--except by train order. A safety-regulated procedure must exist for having extras meet, for example, by train orders or by CTC and Interlocking signals and their respective rules. Without such procedures the extras could run on into what the "rails" call a "cornfield meet," that is, a head-on collision. (For some T and TO cornfield meets see the NTSB items in the references section.) Accordingly, a dispatcher must protect an extra train by providing for its meeting of every other opposing extra train on the line he controls. If new opposing extras are created and run while this extra is still on its trip, he protects it by issuing appropriate train orders to be given to it en route. Regular trains are protected against extras in a similar way. As conditions change (and they always do), the dispatcher provides for new meets between trains through additional train orders. Although no superiority of direction exists between opposing extras, provision is made for regulated meets between such trains. Rule S-88 requires, "At a Form S-A train-order meeting point between extras, train in inferior timetable direction must take siding unless Form S-A or other train orders provide otherwise." Rule S-72 in the timetable (for example, LADT, p. 16) stipulates the superior direction. On the Espee's lines west of Cotton Avenue in El Paso: Westward trains are superior to trains of the same class in the opposite direction."

In the following sections of this monograph, concerning one ethnological field trip I made on one of the Espee's T and TO territories, we expand upon and illustrate the concepts introduced in this apprentice's section. It should be noted that T and TO operations take place in territories with wayside block signals which warn of the presence of rolling equipment on the track and also in ("dark") territories without such fixed signals. In "dark" territories, only the mental application of rules, timetable, and train orders by railroaders keeps the trains apart.

Fig. 4. Clearance for "C&E and Pilot," upper part of Form G order, and message for the OALAT at Watsonville Jct.

TRAIN DISPATCHERS AND OPERATORS

Now sitting on the main line at San Luis Obispo was our freight train, dispatched as Extra 8498 East from Watsonville Jct., one crew district west of SLO. Two diesel-electric units built by General Motors for operation on heavy grades pulled the train. Over the Questa grade, the train had a helper engine cut in mid-train and now cut out of the consist and returning to the roundhouse for reassignment to a priority four train stored in the SLO yard. Our two units were 3000 horsepower models with six axles, each geared to an electric traction motor. The lead unit, the S P 8498, was an SD-40T-2, weighing 205 tons and just built, in 1978. The T meant it was modified for extensive tunnel operations. Our train had originated, as an Extra East, at West Oakland, one crew district west of Watsonville Jct. Discarded by its old crew in the cab of its lead unit was a clearance addressed to "C&E and Pilot," a number of train orders including a Form G order giving authority for engine 8498 to run as an extra train from Watsonville Jct. to San Luis Obispo, and a message to pick up three carloads of tires at Salinas, in John Steinbeck country, destined for an automobile assembly plant in Pico Rivera, in smoggy southern California. These documents (see Fig. 4) were issued by the Coast Dispatcher at Roseville and delivered by an operator at the Junction depot. The old crew knew the documents were no longer in effect but, instead, operationally fulfilled now that the run of their extra had been completed. The numeral designation of an extra train, for example, "8498," is taken from its engine number. Moving away from the San Francisco headquarters of the Espee on any line is designated as eastbound and toward it is westbound. The authority of the Roseville Coast Dispatcher ends at the west switch of SLO. To the east, the authority is with the Los Angeles Santa Barbara Dispatcher, for the Santa Barbara Subdivision.

Our crew prepared to get under way with our train, the OALAT, that is, the Oakland Los Angeles Trailers, to be dispatched east of San Luis Obispo as the first section of regular train No. 832. At the same time, a train dispatcher and several operators in depots along our route were busy working on the train movements over the T and TO line to the east of us. Calculating the probable rate of progress of our OALAT, given its tonnage and its motive power, the dispatcher for our line was at his dispatching "table" on the sixth floor of the Pacific Electric Building in downtown Los Angeles. Other Los Angeles Division dispatchers were at nearby workspaces on the same floor (see Fig. 5). Some controlled single-track T and TO territory either with or without wayside automatic block signals (ABS), and others controlled single track and two main track lines dispatched via Centralized Traffic Control (CTC). Some stretches of main line, as from Burbank Jct. to Los Angeles, were double track with ABS but not CTC.

Briefly, a train dispatcher is responsible for the safe and efficient movement of all trains, on the main lines and many of the branch lines of a railroad territory. He or she is also responsible for the time limits (for occupying or obstructing a line) given to track cars and other rail vehicles (usually used in track repair work) other than trains and engines and to Maintenance-of-Way work gangs. She prepares detailed records of all operations for which responsible, and he fully understands and insures compliance with operating and other rules on the territory, including

applicable statutory regulations. Dispatchers direct movement of trains through: oral instructions not primarily directing the movement of trains; in T and TO territory, issuance of written train orders and other forms; and, in Centralized Traffic Control territory, by manipulations from a remote control panel of wayside signal indications and positions of powered track switches governing routes. CTC signals, when bearing a plate with a letter A (absolute), are control signals and the authority for the movement of trains. Dispatchers should be familiar with the physical characteristics of their territory and should have a knowledge of conditions under which trains operate. A dispatcher directs operators in their line-side depots and towers and others in their duties supporting dispatching. The train dispatcher is under the supervision of a chief train dispatcher. Generally, the dispatcher regulates and balances assignments of operating crews and engines and regulates movement of trains for efficient flow of traffic. He does not want to have his rested crews and most of the engines on the west end of his territory at the time a fleet of freight trains enters the east end.

Fig. 5. A highly skilled train dispatcher, exercising great responsibilities, working on the train sheet for an unsignalled train-order line, over the Cajon Pass. Pedal under table is depressed for speaking to distant points.

In this and the following three paragraphs, we take a bit of a mental excursion on a work topic for more background to this case study and to which an entire monograph could easily be devoted. The dispatcher has all manner of considerations we have not mentioned to juggle in his or her mind. An assistant chief dispatcher, chief dispatcher, and division planner (of traffic flow and customer service) share the considerations. These include timing and priorities in addition to the rule-book considerations such as schedule, right, class, and direction. If a "hot train" "fell down" and became contractually quite late vis-a-vis the shipper-customers, the dispatcher could be told to run it as an extra "with right over everything on the railroad." And indeed, every train would be "in the hole" (siding) for this veritable blue streak of forwarder merchandise.

The superiority of trains according to the rules is meant to be used and manipulated with judgment by the dispatcher: various kinds of actual trains, as opposed to the numbered conventions of timetable schedules to which these trains may be assigned, have differing priorities. On holidays and weekends, when shippers are not open for receiving cars, it is not necessary to maintain the priorities of trains to the usual extent. Priority is a means of determining a rank order of serving customers in a linear transportation system and is not to be confused with class and other superiority, which are elements of rail traffic control. Passenger trains, all first class, of Amtrak and the commuter service of the San Francisco Peninsular have the highest priority, above "one." Priority one, below passenger, is a premium expedited schedule with a so-called green-block-signal commitment. It goes to trains of auto parts--which are synchronized extensions of an automobile assemble line, of assembled autos, and of other important loads. Railroaders know that these trains have "no acceptable delay." In his daily morning report with his division officers, the regional general manager (who "sits on the right hand of God almighty," I have been told on numerous railroads) would scorch any attempts at "alibis" for such delay. Our westbound Coast counterpart, the Los Angeles Oakland Containers, is such a priority one train. The LAOAC handles "hot" cars of premium merchandise. They come from the Los Angeles basin including overseas point via the harbor and from the connecting Blue Streak Merchandise Freight Forwarder (BSMFF) out of St Louis and from the Memphis Blue Streak Merchandise Forwarder

(MBSMF). The last two trains remove trucks from the interstate highways and are closely timed connections of the LAOAC from the transcontinental routes of the St. Louis Southwestern and its parent, the Espee.

Our OALAT(railers) is a priority two train, requiring “priority handling to arrive Division terminal point on time.” For our train, this point is the Los Angeles Transportation Center (LATC), a central marshalling facility for trailers and containers. It is east of Los Angeles Yard and on the site of the Espee's former Alhambra Avenue Roundhouse, Los Angeles General Shops, and passenger coach yard. There the OALAT has connections for blocks of its cars with the priority two trains: LA East St. Louis T, LA Houston T, and LA Avondale T. Also priority two on the Coast is the fabled “Smokey,” the Guadalupe Los Angeles Perishable (GULAP). The “Smokey” picks up during its nightly run refrigerator cars of fruit and vegetables at Guadalupe, Surf, and Oxnard and tri-level cars of import autos at Oxnard, from the connection with the Ventura County Railway (VCR). All these cars go to close time connections with trains out of Los Angeles and West Colton to eastern markets. The VCR uses several former Espee Alco S6 switch engines in its serving of a seaport near Oxnard. Along with other refrigerator cars and trailers of perishable California produce arriving from the San Joaquin Valley, part of the GULAP is reblocked into the Los Angeles Kansas City Perishable, a transcontinental priority two. If necessary, 20 miles east of Los Angeles, the LAKCP can pick up a late arriving block of San Joaquin perishable at City of Industry, from a CI-bound freight bypassing congested Los Angeles Yard. When traffic warrants, a second section or an advanced section of a high priority train is run. In this use regarding customer service, “section” does not have its previously explained meaning in rail traffic control. “Rails” understand the different denotations of this word by context of use.

Premium manifest trains have a priority three and are kept as close to schedule as possible: no delay because of lack of engines or crews is acceptable at intermediate terminals. The chief dispatcher, train dispatcher, yardmasters and others must plan ahead. A priority three example on the Coast is the LA Watsonville Jct. Y (means manifest), hauling empties and doing “peddler” chores of spotting loads and pulling empties between Oxnard and SLO. Finally, priority four goes to manifest and empty trains (most kinds of empty cars, but not those returning for loads of auto parts); if necessary, the dispatcher may lag these trains at intermediate terminals to balance flow of engines and rested crews across his territory. Priority four includes some traffic-actuated trains (when particular yard tracks becomes full of empty cars). A sometimes Coast example is the OALAY. This is called when its cars are not run down the San Joaquin Line via Los Angeles as part of the daily, priority four OA West Colton Y. Under ever-changing circumstances in the field, besides thinking about everything we have discussed under the operating rules, the dispatcher and some other railroaders must think about the nonrule-book policy regulations for the priorities and connections of trains and the setting out and picking up en route of preblocked cars destined to a particular station. In using crews from different seniority districts, these dispatching personnel must also abide by the work rules of the numerous labor contracts on the Espee. Such abiding is a complex mental task worthy of yet another monograph, on the railroad work concerning efficient use of the contractual rules for conditions of employment.

To get a bit ahead, in time, of our narrative, after our First 832 departed San Luis, our train dispatcher had contacted by telephone the operator on duty at the train-order station of Guadalupe, 24.4 miles to the east of San Luis

Obispo. Extra 8314 West, out of Los Angeles early that morning, was approaching our eastbound First 832 on the single track line, and now our meet with this westbound could be further refined. The operator at his desk in the Guadalupe depot prepared for the transmission from his dispatcher. On single track when two opposing trains go by one another, the movement is a meet. When an overtaking train goes by a preceding one on single or double track, the movement is a pass.

As train dispatchers later told me, an operator is their “eyes and hands” and the dispatcher is the “brain” of this field assistant. An operator receives from and transmits to the dispatcher, while under his supervision, information for the management of the movement of trains and engines. The operator transcribes train orders and other kinds of operating documents under exacting standards of safety management for giving to train crews and others. At some stations, he or she manipulates controls which align power track switches and derails and change the aspects of wayside interlocking, CTC, and train-order signals--according to operating rules, timetable schedules, train orders, and other instructions. In the depot, an operator also manages an office for freight, and sometimes passenger, traffic and performs duties related to the business of that office, including meeting the public.

The operator at Guadalupe, as with all other operators, must have his train-order signal displaying a red (means pick-up-orders) indication for both directions while he is on duty (BOR 221). Thus, if the operator is receiving an order which will restrict at his station a closely approaching train, the train must stop for his red signal and will not run by the new restriction of its authority to proceed beyond that point. The train-order signal may be cleared (changed to green) for an approaching train if the operator has no orders for any train from that direction. Train orders are delivered with a train-order signal displaying red. But, if the orders do not restrict the train at that station, they are strung across the two open ends of the arms of the Y-shaped delivery fork of the delivery post. Then, the train crew need only reduce speed to the extent necessary to snag them while in motion, or “on the fly.” A crewmember on engine or caboose leans into the slipstream and spears with extended arm the delivery-fork-strung loop of cord into which orders are folded and tied by the operator, as prescribed by the rules.

When receiving train orders in his depot office, the operator must write or type them in manifold (many copies) (BOR 209). The distant dispatcher dictates his orders at a moderate, even rate because an operator may not copy from memory what has been said several words previously. A prescribed format for all orders is used by the operator with explicit modes of recording numbers, dates, and abbreviations. No part of a train order may be filled out by the operator in advance of the dispatcher’s transmission. If a mistake is made in copying, the operator must notify the dispatcher, destroy the spoiled order, and then receive an entirely retransmitted order from the dispatcher.

As he transmits to an operator, the dispatcher writes the order in the train-order book for his territory. Then the operator must repeat the order to the dispatcher, who underscores each word and number in his train-order book as repeated. The dispatcher then records the time the order is repeated by operator and made complete, by statement to that effect from dispatcher. An operator may not make an addition to a repeated order. If the dispatcher wishes to rescind or change an order’s instruction, he must issue a Form L “Annulling Order” to that effect and, then, issue a new train order under a new number for any additional directive. An order annulled and its annulling order are both

kept together. All concerned realize, however, a dispatcher may not annul the authority of a train if this act leaves the train on a main track without protection.

All “rails” know a train order is in effect as soon as repeated by an operator, whether or not made complete by a dispatcher. Train orders that are repeated or completed remain in effect, as railroaders first learn and then reckon with, until fulfilled, superseded, or annulled (that is, they become void) or voided apart from attaining one of these three voiding statuses (BOR 220), as follows. A part of an order specifying a particular movement may become superseded, annulled or otherwise void. Only the words “INSTEAD OF” in an order allow it to supersede another order. Superseded orders cannot be used again. Various train order forms can be used to annul a schedule, a section of a schedule, a train order, or part of a train order. Every “running order” held by a crew of an extra or regular train becomes fulfilled when the train arrives at the last named station in the order. Orders of work extra trains become void upon expiration of the time limits of the orders. Orders held by a helper engine become void when it separates from the train it helps, unless it has its own orders for running as a separate train, apart from the train helped. Time orders making one train inferior to another become void at the expiration of the time limits of the orders. Orders held by a train which loses its authority become void, except where the rules provided otherwise. Once an order is superseded or annulled, it cannot be reinstated by annulling the superseding or annulling order. Further, a subsequent order may qualify a previous one without superseding it. Fourth 830 could be ordered to display green signals out of SLO (for a fifth section terminating at Surf) and at Surf be ordered to take down these signals. Or an order could direct Extra 9999 West to run late or to wait; and, later, on a subsequent order could direct it to run still later or to wait longer. It is unnecessary to supersede time orders. Clearly, the “rails” have much on their minds regarding the duration of the authority of their orders as they traverse their Coast territory.

As required by rules, the operator at Guadalupe inscribes the printed train-order blank in a prescribed way. In the spaces on the blank, he typed in the following for our use, as dictated by the dispatcher:

1. Train order number: “339”
2. Order date: “JUNE 17, 1978”
3. Order addressee(s): “FIRST 832”
4. Station name: “GUADALUPE”
5. Instructions in body of order:

EXTRA 8314 WEST WAIT AT
 CONCEPCION UNTIL 1130 AM
 SUDDEN 1140 AM
 HONDA 1150 AM
 FOR FIRST 832 ENG 8498
6. Initials of chief train dispatcher: “RMG” [R. M. Gregory]
7. Time order was completed and repeated: “1006 A”
8. Operator’s name: “Faulkner”

A number of rules direct the operator for filling in a train-order blank. In typing the body of the order, he must keep

specified margins and spacing of lines and after the words "WAIT AT" in this form of an order, he must start a new line with station name and time at that station only on that line. Times shown must be spaced in a staggered manner to facilitate reading of the appropriate numbers. Tabulation (arrangement in justified columns) of time in train orders is forbidden. Multiple addresses, on the other hand, must be written in column formation instead of on the same line. This could prevent an operator from overlooking an address. A train order is not properly filled out unless all eight of its parts are finished. The initials of the chief train dispatcher are needed for authoritative issuing an order by a dispatcher (BOR 201; LADT 201, p. 18). All crewmembers of a train or engine addressed by an order must inspect it to make sure that the eight spaces are properly filled (BOR 204).

A number of safety conventions are observed by rule regarding clearances. After the dispatcher has the operator at Guadalupe properly repeat the order, he gives the instruction: "Complete." When the dispatcher indicates he has no more orders for the train (in the present instance, we were to receive only one order), the operator correctly fills out a printed clearance blank (under instruction of the dispatcher). A clearance is a blank that an operator uses for delivering train orders or messages to a train, when authorizing a train at its initial station, and for other purposes according to BOR 82-A and 221-A. The principal use of a properly completed clearance is that of "clearing" a train to proceed when it would otherwise be either stopped or held. A clearance authorizes a moving train to proceed, without stopping, past a train-order signal displaying a red indication. It is a check on the correct amount of and the individual order numbers for all train orders received at a station. When two or more trains are stopped at a station and the operator wishes to clear only one of them, he must do so, safely, by leaving the train-order signal in its red indication and delivering a clearance to the train he wants to move out of the station. The other train has no authority to move out of the station, but it could move and switch cars on the nonmain tracks of the station. When no train orders are to be delivered to a train, and only a written (nonorder) message is to be given to its crew, it is presented by the operator with an operator's clearance--not requiring dictation by the dispatcher. Such operator's clearance must be left blank on the "OK" line. Neither time nor chief train dispatcher's initial may be entered on this line.

The nine spaces on the clearance were filled out by the operator on duty in the Guadalupe depot as follows:

1. Station name: "Guadalupe"
2. Clearance date: "June 17 [19] 78"
3. Addressee: "First 832"
4. Signals: [Not required at this intermediate station]
5. Total number of orders: "1"
6. Individual numbers of orders: "339"
7. OK time: "1048 A"
8. Initials of chief train dispatcher: "RMG"
9. Operator's name: "Faulkner"

As the operator repeats the information on the clearance to the dispatcher, the latter carefully checks the total amount of orders to be delivered and their numbers against the clearance page in his train-order book. When correct, the dispatcher gives permission to fill out lines 7, 8, and 9. That is, the dispatcher gives OK time, and authorizing initials of the chief train dispatcher, which the operator enters on the clearance, along with his own last name. In oral transmission of information in train orders and clearance, certain critical words and numbers, as specified by BOR

206-A, must be clearly pronounced and then spelled out letter by letter. For example, the dispatcher says to the operator (after operator's repeat of clearance):

Guadalupe, G-U-A-D-A-L-U-P-E, clearance with one order, figure 1, O-N-E, order-- number three thirty -nine, 3-3-9; OK to F-I-R-S-T, eight thirty-two, 8-3-2, at ten forty-eight, 1-0-4-8, A.M. Sign it R-M-G.

Such an exacting process of transmission of information for train orders and clearances minimizes the possibility of errors in the sending of these crucial operating forms. Just as with train orders, a crew must read and check their clearance for error or omission. If found, train must not proceed until correction has been made.

When the clearance, train orders, and any messages (on plain paper) are ready for delivery, they are stored in a special place until the train addressed arrives. After hearing his eastward or westward annunciator buzz in his office, caused by the activating of a distant track circuit by a train, the operator must advise his dispatcher of the approaching train. The dispatcher correctly identifies the train to the operator, and if the train is to be cleared with or without further orders he follows his identification of the train with the words "no more." For example the dispatcher might say: "Eastward train Guadalupe is First Eight Thirty-Two. Guadalupe, no more."

With the departure of each train from his station, the operator must promptly record on his Station Record of Train Movement the time of departure and must give an OS (means on "train report" sheet) to the dispatcher. The dispatcher promptly enters the OS time on his train sheet, which records the progress and circumstances of all trains on his dispatcher district. When "OSing" trains, departing time should be the time that the rear of train (with its marker train signal) passed the point where time applies for a train at that station, or the time marker enters main track if train departs from other than main track. The presence of a marker allows the operator to know that the entire train is present. Absence of marker may mean that part of the train is temporarily left behind and that the engine will go back to retrieve the other segment of its train. It could thus be hazardous to OS a correctly identified engine of an expected train, if the movement goes past without a marker. Logically, engine 5555 and many cars of Extra 5555 East may have gone by, but train Extra 5555 East has not departed if its marker does not go past.

Now that the reader has a minimal apprentice familiarity with reasoning according to the rules for T and TO operations and the part played by the train dispatcher and operators in these, we can board First 832 and see the use of some of the rules in the field. But, before we begin our trip, a brief overview should be given of the range of variation of the train order forms used on the SP. Generally, these forms, with a few changes, are used on other North American railroads and are derived from the Standard Code of Operating Rules of the Association of American Railroads (AAR 1980). Forms with an S prefix before another letter are for single track or for multiple main track only. A D prefix before another letter identifying a form means it may be used for double track operations only, except Form D-A as specified. Forms identified by a single letter, without S or D prefixes, may be used for single, double, or multiple main track. Multiple main track is two or more main tracks designated by direction or by number in the timetable, for example, eastward and westward or No. 1 Track and No. 2 Track between Able and Fox.

Train order forms (that is, conventional arrangements and presentations of information) are of twenty-five kinds on the Espee (BOR, pages 89-125). A standard variation of a form is labeled as an example . Most of the forms, from S-A through Z, will be explained and exemplified in the following subsections. These forms are as follows:

- Form S-A "Fixing Meeting Points for Opposing Trains"
- Form D-A "Providing for Passing of Trains in Opposite Directions When Load(s) of Excess Width Involved"
- Form B "Directing a Train to Pass or Run Ahead of Another Train"
- Form S-C "Giving Right Over an Opposing Train"
- Form D "Giving Right Over Another Train in the Same Direction"
- Form E "Time Orders"
- Form S-E "Time Orders"
- Form F "For Sections and Authorizing Regular Train at Intermediate Station"
- Form G "Extras"
- Form H "Work Extras"
- Form I "Relief of Protection by Flagman Against Following Extra Trains Outside of Block System Limits"
- Form J "Holding Order"
- Form K "Annulling a Schedule or Section"
- Form L "Annulling an Order"
- Form M "Annulling Part of an Order"
- Form N "Calling-On Order"
- Form P "Superseding an Order or Part of an Order"
- Form Q "Issuance of New Timetable or Supplement"
- Form D-S "Providing for the Use of a Section of Double Track as Single Track"
- Form T "Change of Engines on Extra Trains"
- Form V "Check of Trains"
- Form W "Change in Clearance or Register Requirements"
- Form X "Track Conditions (Other than Form Y)"
- Form Y "Conditional Stop Sign Order"
- Form Z "Signals Taken Out of Service or Restored"

DELAY AND DEPARTURE OF FIRST 832

The dispatcher held our First 832 on the San Luis Obispo eastward double track for a short time. Far to the east of us was Extra 9280 West. This extra was a lengthy and heavy train of open-top cars loaded with sugar beets, and constituted an NC, or nonclearing, train. NC trains are too long to fit into any siding on a particular single-track line. Failures or difficulties had occurred with all of the four diesel-electric units pulling the NC beet train. Our dispatcher held us so that with our mile-long train, we would not encounter a main track blocked by a disabled train that was too long to fit into any siding en route and thus clear the main line. When the dispatcher thought the NC train could make

it to the several miles of double track at Santa Barbara, he allowed us to assume our schedule. In the cab of our engine, after previously rechecking his train orders and making some calculations, conclusions, and mental notes, our engineer prepared to release his engine air brakes and stretch a foot or so of slack in each of his trailing cars. We were ready to run eastward, as limited by our crew's interpretation of the rules and documents for T and TO operations. One such document was our (train) register check.

Our conductor made the check of the train register and recorded this act on the proper blank at the time he registered our train (BOR 83, 83-A, 83-B, 83-C, 83-D). A train register is a book or blank used at designated stations for registering signals displayed, time of arrival and departure of trains, and any other prescribed information. At stations such as San Luis Obispo, all regular and extra trains register in accordance with BOR 83-A. By means of a register, it can be determined if trains superior by right or class have arrived or departed. A conductor should not register his train until he has received his clearance. He could enter incorrect information concerning engine number, signals displayed, and so forth and then forget to change the misinformation when he receives his clearance form with the officially correct data.

As required by Rule 83-C, our conductor gave our engineer a copy of the register check. With it the engineer could comply with BOR 83 and not erroneously leave the initial station with FIRST 832 (or a junction, or an intermediate point where schedules originate or terminate, or pass from double track to single track, or from CTC or Interlocking to other track) until it was known that all superior trains due had arrived or left, or that the train had authority to proceed. According to Rule 83-C, the engineer must check the register blank for information needed regarding superior trains that have arrived or left. A train may register against an extra only when authorized to do so by train order From W "Change in Clearance or Register Requirements," Example (4); for example:

SECOND 834 MAY CHECK REGISTER AT SAN LUIS OBISPO AGAINST EXTRA 9999 WEST
ON ORDER NO 55

Train order Form V "Check of Trains" may be used, and when it is received by crewmembers of a train, it is not necessary to check the register against schedules of other trains. According to Rule 83-B, a train may register by leaving a register ticket on prescribed blank with the operator at train register station when authorized by timetable or train order, or when train-order check of trains (Form V) is received. When so authorized, the operator must enter on the register information contained on the ticket and then "OS" (report) the train from the register. For example, leaving Los Angeles Yard westward for San Luis Obispo on the double track under Rules D-97 and D-251, Extra 7604 West of June 30 received a clearance marked "No orders." All that was needed under these two rules for double track was a clearance. At Burbank Jct., before entering the T and TO single track line to San Luis Obispo, the extra received a clearance with several orders. One was a Form V "Check of Trains" reading:

REGULAR TRAINS DUE BURBANK JCT ON SANTA BARBARA SUBDIVISION BEFORE 1120 PM JUNE 30TH
HAVE ARRIVED AND LEFT EXCEPT FIRST 834 ENG 8842 AND SECOND 834 ENG 8993

Our register check for First 832 showed that no superior trains due at San Luis Obispo had arrived or departed on

June 16. On the check blank our conductor, as customary, had recorded our loads (55), our empty cars (1, the caboose), our total tons of the cars in the train (3837), and the length of the entire train in feet (5161). He also noted we had 65.8 tons per operative car brake.

Our clearance directed us to display "GREEN" train signals for a following section (Second 832) of our schedule, No. 832. Today, No. 832 would be run as two trains. The second section, some several hours distant, would be a heavy 10,000-ton lumber and paper-products movement originating in Portland, Oregon, helped over Questa, and destined for the Los Angeles-Orange County market. Another day, 832 would be three sections and on other days it would be one. If rail traffic were disrupted by a severe line blockage, No. 832 could be annulled for a day or two and, then with the unplugging of the line, perhaps nine sections would be run. On the front of the lead diesel-electric unit, our engineer changed the color of the classification lights, one on either side of the nose, from white, which had been the signal color for the extra train that our rolling stock constituted into SLO, to green, the signal of a nonfinal section of a regular train. Should both of our green train signals fail en route, we would be required by Rule 20 to notify all trains we meet or pass of our status as a leading section, stopping if necessary. Our clearance also listed five "running/train-movement orders" and two "track/slow orders." As required, the running orders, with lower order numbers, were listed in numerical sequence on the upper lines of the clearance and the Form X track (condition) orders, with higher numbers, on the lower lines.

Form X order No. 1948 instructed us not to exceed certain speeds at three locations to the east of us and Form X No. 1922 informed us:

SIDING GUADALUPE IS BLOCKED WITH CARS

We would not plan on meeting any train at that siding. The siding was blocked with sugar beet cars for Union Sugar's beet-processing plant on the Santa Maria Valley Railroad, interchanging with the Espee in the yard at Guadalupe station. The SMVR uses a number of General Electric 70-ton switch engines, often as multiple units.

Fig. 6. The OALAT running as First 832 on the eastbound main track at San Luis Obispo. Green classification signal lights are illuminated on either side of the nose of engine 8498. Head brakeman approaches the train.

Fig. 7. In SLO, our engineer works the throttle while monitoring the ammeter as he stretches his mile-long OALAT.

When the dispatcher released us, our conductor called over the radio and conferred with our engineer, and then ended: "... Everybody's on. Highball, First 832." With this authority to move from our "skipper," the "hoghead" tolled the engine bell, moved his front headlight from dim to bright, released his engine compressed -air brakes, and then began easing back on the throttle. He advanced just to the run-2 notch of the throttle, until he stretched the slack in the draft gear on all cars and these were barely in motion. "First 832, we're moving on the rear end," reported the

conductor. Slight wisps of smoke puffed from our exhaust stacks and the diesels chanted somewhat louder as the “hoghead” with an eye on his ammeter began moving further back on the throttle. Our first, busy city, road crossing at a grade was ahead. With his roof-mounted air horns, he whistled the standard crossing signal of Rule 14(l) (- - o —, two longs, a short and an extra long, until our lead unit was over the street). We were limited to 35 mph on the rest of the three miles of double track, in the suburban SLO setting, and through the spring switch onto the single track to Santa Barbara. In a trailing movement, a spring switch (bearing a white plate with the black letters S S) may be run through and need not be thrown by hand (BOR 535-540). As the caboose clunked through the spring switch and entered the single track, the rear brakeman so informed us over the radio. In the next eight miles, around the bases of some hills and through a cool canyon that had not yet seen the morning light, we encountered and decelerated for a number of curves posted at 30 mph for freights. Before long, with whining dynamic brakes on a ruling 1 percent downgrade, we had accelerated to our unrestricted track speed of 55 mph as we neared Pismo on the misty Pacific shore. Beyond, in 1 mile on level track, was the station of Grover with its 6308 foot siding, and then in 2 miles was Oceano with its preserved depot and short 1782 foot siding. Such a siding is suitable only for passenger trains and some local freights that spotted the lumber yard and the produce packing houses there. Besides the main siding, Oceano has a storage track and eight spur tracks, with which the conductors and brakeman must be familiar in their station switching. Four miles further on was Callender, the station of origin of eastbound unit trains of the coke made by Union Oil from petroleum byproducts and destined for use at a facility in the Mojave desert on the Trona Railway. Callender, with its four long spurs each of about 1000 feet and its siding extension for storage of cars, was the place of our first meet with an opposing train. A siding is found at most stations and is a track auxiliary, usually parallel, to a main track and is used for the meeting or passing of trains or storage of rolling equipment. At both ends, it has a switch connecting to the main track. Stations often have a spur (with a switch connection at one end to the main or other running track such as a siding) and sometimes a short storage track (with connections at both ends to a running track). But a station could have no other track alongside the main track. And, of course, it need not have any building or other structure.

For this meet, order No. 323, addressed to NO 830 and NO 832 read:

EXTRA 8871 WEST HAS RIGHT OVER NO 830 AND
 NO 832 WEST SANTA BARBARA TO EAST SAN LUIS OBISPO
 THIS ORDER ANNULLED AT 410 PM

The first two lines comprise a Form S-C “Right Over Opposing Trains” order. And the third line comprises a Form L order, “Annulling An Order”—in its entirety. (Form M “Annulling Part of An Order” is used when a particular movement or portion of movement in an order is to be annulled, and does not affect other movements in the order.) Form L may be used as an independent order (ORDER NO 100 IS ANNULLED) or combined with other forms, as in the above order No. 323. With Form L, our dispatcher could flexibly either immediately cancel a directive or else set time limits on how long it is in effect. Railroaders call a Form L, a “stinger.”

A Form S-C “Right Over Opposing Train” order is a fundamental building block of T and TO dispatching. A related

but less used Form is D, a "Right Over Train in Same Direction" order. On single-track T and TO territories, a train is superior to another train by right, class, or direction and right is superior to class or direction (BOR S-71). As "rails" realize, only forms S-C and D generically confer right. (Form G "Extras," Example 6, and Form H, "Work Extras," Example 12, orders do so also, in those specific examples only.) Logically, any "right order" takes away the superiority of a train with regard to another. Such order requires the formerly superior but now inferior train to clear the time of the now superior train by as much time, if any, as required by rule. The crewmembers of a train newly made inferior can move as far along their run as they judge, just so they properly clear the newly superior train. Railroaders understand their frequently used term proper to mean "in accordance with the applicable rules."

Thus on our run, opposing Extra 8871 West had superior right conferred by the Form S-C order over our regular second class train all the way to San Luis Obispo, until the 4:10 P.M. time of the "stinger," the annulling part of order No. 323. According to the directive of order No. 323, we realized First 832 could not leave the double track at East San Luis Obispo (see our schedule, Fig. 2) and enter the single track until either Extra 8871 West arrived or until 4:10 P.M. We, however, had been given a more recent, refining order--No. 337, addressed to FIRST 832:

EXTRA 8871 WEST MEET FIRST 832 ENG 8498 AT CALLENDER

Both opposing trains now had the exact same Form S-A "Fixing Meeting Points" order. This form is another fundamental building block of T and TO dispatching. In a Form S-A order, a train may be directed to meet more than one train at a station: "EXTRA 9010 WEST AND EXTRA 9394 WEST MEET THIRD 830 ENG 8866 AT GROVER." At a "straight meet," stipulated by Form S-A train order or a schedule, the inferior train takes siding unless the contrary is specified. Because they are not scheduled in the timetable, one extra train cannot be superior to another extra by class or direction. Therefore, Rule S-88 prescribes which will take siding. At a Form S-A meeting point between extras, the train in the inferior timetable direction must take siding unless otherwise specified. Additions to a Form S-A order of "HOLD MAIN TRACK" or "TAKE SIDING" may be used to reverse the normal stipulation of who will take siding. This use permits greater flexibility in dispatching trains. Such flexible additions may also be used to advantage with Form S-C orders. For example, had the Extra West been running quite late and had we been the superior train at the Callender meet, the dispatcher could have ordered, by Form S-A, Example 10: "FIRST 832 ENG 8498 TAKE SIDING MEET EXTRA 8871 WEST AT CALLENDER."

Logically, a train directed to meet another train by train order, or by timetable schedule, must go to the meeting location and not beyond. It must wait at that place until the train to be met arrives, with certain stipulated exceptions. As every "rail" reckons, a train has not been met until its marker arrives. A crew of a waiting train may leave a Form S-A meeting location only: (1) upon receipt of notification of annulment of the opposing train--by means of a Form K "Annulling a Schedule or Section" order (NO 12 OF JUNE 30TH IS ANNULLED SAN LUIS OBISPO TO LOS ANGELES), (2) after the schedule of an opposing regular train is twelve hours late, (3) after a new timetable takes effect while waiting and it schedules no such opposing train, (4) after the Form S-A "meet order" is annulled by annulling Forms L or M, or (5) after a Form P "Superseding" order is received against such a train --thereby superseding the underlying meet order.

Because Form S-C “Right Over Opposing Trains” order No. 323 was still in effect for our First 832, Extra 8871 West was still superior to us by train-order-bestowed right. Therefore, we were required to take siding at Callender station (see Fig. 2) for the Form S-A straight meet with the extra required by order No. 337. With a Form S-A “Fixing Meeting Points” order, the inferior train takes siding unless a train order directs otherwise. Accordingly, as we approached our meet with the extra at Callender, we found a red block signal—beyond which was the Extra West, stopped and “holding the main line against us.” When we signaled by dimming our headlight, they replied by extinguishing theirs (as per BOR 17, 17-C). Each crew thereby signaled they understood the meet about to occur. Headlights are not just for illumination but also perform a variety of signal functions under the rules.

Decelerated, we prepared to run off the main track through the siding as per the ruled cautions for sidings of BOR 105 and at the prescribed 10 mph for running along most sidings. The head brakeman of the opposing extra train had already “bent the iron,” aligning the west main line switch into the Callender siding for us and then had stepped across the main line as compelled by BOR 104-A and 104-C. (The rules prescribe and proscribe many acts on the job, that we do not have the space to consider in this brief monograph. Among the many prohibitions promoting safety, to prevent an employee from panicking at the last minute and incorrectly realigning a siding switch in the face of an on-rushing train, he may not remain either within 150 feet of or on the same side of the track as the lever controlling a siding switch after having aligned it for a meet or pass.) When we approached, the brakeman hand-signaled us to “come ahead,” with a standard motion of his arm. From his safe location prescribed by the rules, the brakeman would give our train a roll-by inspection, per Rule 829.

Approaching the engine and, then, the caboose of the extra, as we ran along the siding, our engineer sounded engine whistle signal 14(k) (- o o, or a long and two short blasts). On single track, this signal calls the attention of engine crews and train crews of trains of the same class, inferior trains, yard engines and of trains at train-order meeting or waiting points (such as here at Callender), to (green) signals displayed for a following section, unless otherwise provided by timetable. Signal 14(k) is acknowledged by whistle signal 14(g) (o o, or two short blasts) and, for the trainmen standing on the ground or in the caboose, hand signal 12(c), which signifies “proceed” and “answer to signal 14(k).” Incidentally, Rule 14, in its part (k) has seventeen lines of requirements of when and toward what kinds of trains the signal must be used and how it must be responded to when received (all of this differs on single and double track). To make the work of railroaders comprehensible to the average reader in our discussions, we avoid going into this level of detail and complexity of their mental tasks.

Recognition of the significance of a train carrying green signals is a vital worktask. As rules specialist Peter Josserand informs, “The green signals displayed for a following section are, at times, a deadly stop signal” (1957:119). This is because an inferior train might have no other information that a schedule is being run with more than one section. Thus, as we have seen, under the rules a red fixed train-order signal at a station does not always mean stop, but green train signals on the front of an engine could mean stop. The mental skills of the “rails” interpret the meaning of a color symbol for a signal as appropriate to the ever-changing circumstances (cf. Gamst 1975).

When we neared the caboose at the east end of the extra, we could see up ahead our turnout aligned from the siding back onto the main track a short distance beyond the caboose. Our conductor let us know via radio as our own caboose neared the turnout to the main track: "...Ten cars; two cars; highball, First 832; we're on straight track." The rear brakeman of the extra would realign the siding track switch for us from its present reverse to its normal position.

Seven miles east of Callender, about a mile beyond the bridge over the Santa Maria River, was Guadalupe, a station marked "TO" in the column of stations on our classified timetable schedule. The two letters meant that Guadalupe was a train-order station for us, and we saw a red train-order signal mounted on a tall mast in front of the large, brand new, metal depot. After our engineer had snagged and taken into the cab the loop of cord on the delivery fork of the train-order delivery post, we read the clearance and single order tied in the cord. The distant train dispatcher and the Guadalupe operator had previously prepared these directives for us. Our trailer train continued over the countryside without stopping: we judged that the red train-order signal indicated to proceed in accordance with applicable rules. Ruling grades on our route, both ascending and descending, would be mostly 1 percent all the way into the Los Angeles basin. The alignment and profile of our route was rather like that of a twisting roller coaster, either up or down, but seldom level, and constantly presenting another curve up ahead. First 832 with engines roaring bit into the teeth of the 8-mile, 1 percent ascent past Waldorf station of Shuman summit, all in the coastal Casmalia Hills

At SLO, one of the orders we received, No. 335, was a Form S-C "Right Over Opposing Train" that read:

EXTRA 8314 WEST HAS RIGHT OVER FIRST 832 ENG 8498
WEST SANTA BARBARA TO SURF RIGHT OVER SECOND 832 AND NO 834
WEST SANTA BARBARA TO EAST SAN LUIS OBISPO

The S-C order required that we not go beyond Surf station for the Extra West. This order established the first-named train as a train of superior right over the three otherwise superior, by class, opposing eastbound trains. Focusing upon that part of the S-C order applying to us, our crew reasoned the following. Extra 8914 West is superior to us by Form S-C train-order right between the points "where time applies" at the two stations named (West Santa Barbara and Surf) in the order. If the trains meet at either of the two designated points, the first-named train, the extra, must take siding, unless the order had prescribed otherwise. The extra is ordinarily inferior to our regular train and has no train-order superiority at the two stations; therefore, if First 832 meets it at either location, the extra logically takes siding.

Because our First 832 had no authority to go east of Surf to meet the Extra West, where exactly at that station would we meet it? Where does "time apply"? BOR 5 supplied our answer: "Unless otherwise provided, time applies at the clearance point of a siding where an inferior train must be clear of main track; where there is no siding, it applies at train order signal; where there is neither siding nor train order signal, it applies at station sign." (The "otherwise provided" under Rule 5 is shown for our route, regarding Burbank Jct., on the upper right of our schedule, Fig. I.) Our timetable schedule shows us that Surf has a siding with a capacity of "5550" feet and that it is also a "TO"

station. At Surf, the Extra West loses its superiority by train-order conferred right over our train. Rule 89 states that trains required to take siding must head in at the initial, first reached, siding switch when practicable. The westbound extra is inferior to our regular First 832 beginning at Surf and therefore takes siding at the east switch.

Train order No. 339, received from the operator at Guadalupe, allowed us to modify the requirements of the S-C order giving the extra right over us to the east switch at Surf. Order No. 339 is a Form S-E "Time Order" reading:

EXTRA 8314 WEST WAIT AT
CONCEPCION UNTIL 1130 AM
SUDDEN 1140 AM
HONDA 1150 AM
FOR FIRST 832 ENG 8498

Still the superior train, the Extra West is restricted at the named stations until the stipulated times. Building upon the previously issued orders, this one allows us to calculate our advancing of our train against the extra's realistic progression, something difficult for the dispatcher to determine until two opposing trains are relatively close to one another. If we were to arrive at Concepcion by, say, 11:25 A.M. and were identified by the extra, it could proceed without waiting any further on the S-E order at Concepcion, Sudden, or Honda. The S-E "Time Order" merely restricted the extra at Concepcion until 11:30 A.M. for the arrival of our First 832. Logically, after that time event, its crew and our crew know it may depart Concepcion. With the S-E order, we were allowed to run as far as we could judge, but with respect to the times specified for the extra. BOR 86 requires that our train be clear of the main track at a particular station before the leaving time of an opposing superior train at that station. Thus if we wanted to run to Honda, the next station ahead of us to the east of Surf, we would have to be in the clear on Honda siding by the leaving time of the extra at Honda (or 11:50 A.M.).

Previously mentioned was the requirement that trains must be identified by train crews in certain territories. Trains must be positively identified, ordinarily by the engine number on the lead unit (BOR 21). Each operating employee on a train must assist with such critical identification. Certain non-T-and-TO territories, for example with CTC or double track, may also have rules requiring the identification of trains. This information is used when crews enter adjacent T and TO territory. Special instructions in the timetable designate non-train-order territories where positive identification must be made. On our route, such territories include the double track at San Luis Obispo, Santa Barbara, and from Burbank Jct. to Los Angeles Yard (LADT, page 33).

Under now gray, damp, chilly, marine skies, our First 832 ground up to the apex of the 1 percent grade doing 20 mph under full throttle, in throttle run-8. Then, with its 3837 trailing tons and all of our 6000 hp at work, it crested the summit at Shuman. Accelerating, we moved downgrade through Devon, 1 mile beyond, and 5 miles farther on we were in sight of the shore once again, a few miles west of Narlon. From here to Ventura Jct., 105 miles to the east, the railroad runs along the shore which varies from breathtaking to merely spectacular. We roared downgrade at a maximum of 55 mph past Tangair at 11:28 A.M. The Extra 8914 West opposing us still had to wait until 11:30 A.M.

at Concepcion, four stations and 28.1 miles to the east. This Sunday, our train had only two diesel units; on weekdays it could have up to four. Could we make it down into Surf and then labor up the 1 percent to Honda in about 15 minutes, some 10.7 miles? That would put us at the west switch of Honda siding by about 11:43 A.M. Plus another six minutes to get our train off the main track entirely in the clear on Honda siding would make it 11:49 A.M. On Order No. 339, above, the Extra West was due out of Honda at 11:50 A.M. Had we been able to run over the road from Tangair to Honda in only 15 minutes, we were allowed to meet the extra at that station. The 1 percent upgrade out of Surf toward Honda, however, would slow us as had the grade into Devon. Thus, we inductively calculated we could not get in the clear on Honda siding until after 11:58 A.M. and we had no right of the road to be on the main track at that station as of 11:50. Accordingly, we must "hold the main track" at Surf and meet the extra there. Our crew's calculations of locomotive condition and horsepower, trailing tonnage, gradients, route distance, and 10 mph speed through siding for a mile-long train determined that we must wait at Surf for the opposing train, made superior to us by train-order right westbound to that station.

CHANGED CHANGES AT SURF

First 832 plunged downgrade from Tangair to Surf through the foggy, sunless, late morning and came to the long bridge across the Santa Ynez estuary just west of Surf. At the east end of the bridge, the Lompoc Branch stretched to the left out of the wye track at Surf; a long cut of freight cars stood on an approach to this diverging line. As we entered Surf in the murkiness along the Pacific coast, an engine sat on a spur just before the depot, to our left. The engine was for the local that worked the Lompoc Branch penetrating the Lompoc Valley, with its fields of commercial flowers in season, and ascended the White Hills Branch diverging with its 2.3 percent grade, to a diatomaceous earth mine of Johns Manville. To the right of our single main track, the train-order signal showed red. The dispatcher had additional orders at Surf for us.

Past the Surf depot our train pulled eastward, holding the main track, and was in the clear of the east switch of the Surf siding, thus permitting the extra to enter that initial switch, where it lost its right over us. While we waited for Extra 8314 West to appear, we reviewed the orders we snagged at Surf. Our clearance from the operator at Surf bore the notation that we had two train orders; both were addressed to First 832. Order No. 346 read:

NO 13 ENG ATK 617 WAIT AT
WEST SANTA BARBARA UNTIL 1230 PM
GOLETA 1245 PM
CAPITAN 1250 PM

This is a Form E "Time Order," which requires No. 13 to wait at the named stations until the specified times; after those times, the order is fulfilled. Our First 832, after properly meeting Extra 8314 West at Surf, could proceed against No. 13, Amtrak's Coast Starlight. We would first have to observe its timetable schedule (Fig. 2) from Surf (where it was due to leave at 1:31 P.M.) to Gaviota (due to leave 12:55 P.M.) As it was not yet even 12 noon, the schedule times at these stations would not hinder our movement. By rule, a regular train must not leave a station ahead of the departure time in its timetable schedule. Beginning at Capitan, Order No. 346 gave us additional time

against the schedule of No. 13, because it was running late. We could then continue to proceed provided we could clear the superior, first class, No. 13 before its order-specified leaving time at each station in advance (to the east) of us (BOR 86).

The other order, No. 347, regarded Extra 9280 West, the nonclearing, sugar-beet train out of Los Angeles that had been having difficulties with its locomotive units. At San Luis Obispo, one of the orders given us was a Form S-C "Right Over Opposing Train" order stating that Extra 9280 West had right over No. 832 Burbank Jct. to East Santa Barbara. Such wording, logically, includes all sections of that schedule number. Apparently the engineer on the extra had corrected all or most of his engine difficulties, and the dispatcher was more optimistic in estimating the potential progress of the beet train to the west of Santa Barbara. Thus, the dispatcher had dictated to the operator at Surf the following order No. 347:

FIRST 832 ENG 8498 WAIT AT
CONCEPCION UNTIL 1202 PM
GAVIOTA 1215 PM
FOR EXTRA 9280 WEST

This was a Form S-E "Time Order," which restricts our First 832 at the names stations until the specified times unless the second named train, Extra 9280 West, arrives.

Our progress against No. 13 and Extra 9280 West, after the arrival of Extra 8314 West at Surf, was well planned by the dispatcher and, following the train order forms and related operating rules, precisely clear to us. Because of the written stipulations of the forms and the numerous relevant impinging rules, we knew our movement opposing these trains on the single track line would also be similarly clear to the crews of the two trains. After all, the purpose of written railroad operating rules (since at least the late 1700s) is a common understanding of the procedures for safety and efficiency in the movement of trains.

Far to the east of us a mechanical problem occurred. All of the diesel units on the beet Extra 9280 West failed. The long, heavy train was blocking the busy single track main line between the San Francisco Bay and Los Angeles areas. Through the operator at Surf, the dispatcher orally instructed us to put the cars of our mile-long trailer train into the siding at Surf, which would thereby be blocked with our cars. (The dispatcher would have to issue a train order to all trains informing them of this operational change in the status of Surf siding.) Next, the dispatcher said he wanted our First 832, as a two-unit engine without any cars but displaying a red marker as a train, to run quickly eastward over the road. We would run under new train orders, at one of the timetable speeds for passenger trains. Upon reaching the dead-on-the-rails beet extra, First 832 would cease to exist and be transformed into a helper engine for the extra. Our now nontrain engine 8498 would couple ahead of the extra train's engine, "doublehead" it westward, and pull it into Santa Barbara yard. Our engine would be transformed during this helping, from eastward First 832 to part of Extra 9280 West. Under still other new orders received at Santa Barbara, we would then run westward back to our cars at Surf as an engine-only train, Extra 8498 West. We would thus have to display white classification signal

lights as an extra and a marker as a train.

As yet, our First 832 had no train-order authority to pull ahead on the main track to the east of the east switch at Surf and then back westward into the siding. Extra 8314 West had right over us to the initial (east) switch at Surf and would not expect us to be occupying that stretch of the single track main line east of Surf. We had to back our train westward on the main track until the lead unit of our train cleared the west switch at Surf siding. Then our 5161-foot train could pull ahead, eastward, into the siding, which our timetable said had a length of 5550 feet. Because First 832 also had no timetable or train-order authority to make a westward movement out of Surf (either backing or moving forward), we had to comply with Rule 515: "A train having passed out of a block must not back into that block except under protection by flagman, as provided for in Rule 99-A, or as otherwise provided for in Rules 670 or 763-A." (A block is a length of track between consecutive wayside block signals governing in one direction.) Rule 763-A pertains to CTC territory and 670 to Interlocking territory. We were in neither at Surf, so, logically, Rule 99-A obtained. This last instructed us to comply with Rule 81-A (which was physically impossible in this instance) or else Rule 99, the basic flag protection rule. Accordingly, our rear brakeman went out with his flagging signals, stipulated in related Rule 35 and previously enumerated, a sufficient distance to protect the rear of our train at the furthest point of its westward backing movement on the main track toward Tangair, to the west of us. After the flagman was in position and had his torpedoes and fusee down on the track, we could back our train. First 832 backed through the foggy mists with our engineer in constant radio contact with our conductor, who was guiding the movement from his caboose almost a mile to the rear of our lead unit. In all, not having authority to thus occupy the main track west of Surf, we provided protection for our train

While backing our train, we also had to comply with backing Rule 836, most of the radio Rules 950-973, and the 16 paragraphs of air brake and train handling Rule 61.A.4 ("Starting Back-up Movement"), all stipulating the requirements for such a move. The many stipulations of the train handling rule are crucial because the great electrical power of a multiple-unit engine against a heavy train easily generates sufficient compressive buff forces to jack-knife cars, cause wheels to climb over a rail on a curve, and overturn rails. Radio Rule 967, incidentally, prohibits an operator from informing a train crew of the indication of his train-order signal. A train crew alone is responsible for determining whether a train-order signal indicates green-proceed-no-orders, red-proceed-with-orders, or red-stop-for-orders.

After we had stopped backing, moved forward, and finally come to a halt entirely within Surf siding, we continued to wait for Extra 8314 West. This extra would stop at the east siding switch and learn from our head brakeman that it would have to proceed westward on the main track. Having met and identified our train and not otherwise being restricted at that station, the extra's crew could proceed westward. Next, we received a call on the radio: "SP Surf Telegraph to First Eight Thirty-Two." The operator at Surf informed us that we would no longer be ordered to cut our 8498 off our train and run to help the beet extra. It now had full power in one unit and partial use of a second (two units were totally dead) and would limp into the double track at East Santa Barbara. In this way the beet extra would not tie up the Coast route. At the end of his transmission to us the operator said: "SP Surf telegraph, clear." Our big adventure, within the confines of our use of the rules, was over shortly after it had begun. We, however, were already

discussing and planning our three kinds of future movements: as a light-engine regular train, as a helper of an Extra West, and as a returning light-engine Extra West. A light engine has no cars of any kind.

The dispatcher had been forced by altered circumstances to change his change of what he had planned for us. In railroad work, changes are a background constant. Because even routine undertakings cannot be anticipated fully and the unanticipated is ever-present, operating personnel must know and abide by the applicably changing myriad of interconnected and complex written rules and procedures for railroad movements. Rule books, timetables, timetable bulletins, clearances, train orders, and messages must be read and kept at hand for ready reference to check upon the propriety of a planned move, especially as conditions change--as they invariably do. In planning intricate movements, members of train crews confer with one another.

Finally, Extra 8314 West "showed its color"; the eastward main line block signal facing us at the east end of Surf changed from its steady green to yellow, and, a little later at 12:12 P.M., to red. The Extra passed the block signal and approached us, while we waited on our lead unit in the Surf siding. Its caboose and marker were by us at 12:19 P.M. We had met the extra.

Fig. 8. Extra 8314 West "showed its color." Then the Extra passed the block signal and approached us, while we waited on our lead unit, 8498, in the Surf siding. By rule, we were stopped 400 feet from the fouling point to the main track.

A second clearance and a new order were brought up to our lead unit by the engine of the Lompac local working at Surf, that we had passed earlier. The Lompac engine, its freight cars, and caboose moved entirely within the operating territory of yard limits at Surf and the length of the Lompac Branch leading out of Surf. Thus it did not constitute a train and could not bear a marker.

Written before the label "CLEARANCE" on the blank was the word "Second." All orders for delivery to a train at a station must be shown on the second clearance (BOR 221-A). Our new Form S-E Order No. 350 "gave us time" on No. 13 from Honda through Gaviota. More time was given to us against No. 13's timetable schedule, which for example was 1:09 P.M. at Concepcion, but restricted to 1:25 P.M. by the S-E order, which read:

NO 13 ENG ATK 617 WAIT AT
GAVIOTA UNTIL 115 PM
CONCEPCION 125 PM
SUDDEN 145 PM
HONDA 155 PM
FOR FIRST 832 ENG 8498

After we left Surf, the fog lifted and we rolled along our sun-lit, curving right-of-way, which had numerous substantial bridges spanning inlets from the Pacific Ocean. As we leaned out of the cab window for a rearward view to inspect our train, the highway trailers and containers on the flat cars in our OALAT glistened as the sun reflected off their silver sides. We calculated that could only make it as far as Concepcion for No. 13, Amtrak's Coast Starlight. Our engineer skillfully coordinated use of the automatic air brakes and then the independent air brakes to slow our train and halt it before the initial (west) switch at the Concepcion siding. The heavy exhaust of compressed air in our cab had a faint "oily" odor. An introductory explanation of the use of the power throttle and the four brake systems of a train in accordance with the Espee's 146 pages of air-brake and train-handling rules and 59 pages of definitions and functions of related equipment would be the subject of still another entire monograph.

Following our roller coasting from Surf, 5 miles to Honda, 9 miles to Sudden, and 8 miles to Concepcion, our head brakeman lined the switch for us from the main track into Concepcion siding. Our rear brakeman would line it back for the main track. First 832 pulled up in the clear on the 10 mph siding and rested on the long curving track parallel to the main track upon which opposing No. 13 would soon hurtle past. While we were "in the hole," our "hoghead" explained that in the ocean near Honda siding was "Destroyer Rock." There, during the 1920s in a dense fog, several U.S. four-stack destroyers ran into the rock. Their rusting, broken hulls still rest there. Our head brakeman stood across from us beyond the main track, by rule, so that he could give the "varnish" (passenger train) a roll-by inspection in accordance with other rules. At 1:32 P.M. No. 13, engine Amtrak 617, was upon us and then was far beyond us by 1:33 P.M. So we could positively determine that we had met No. 13, one of the orders, No. 336, we received at San Luis Obispo informed:

NO 13 HAS ENG ATK 617

NO 12 HAS ENG ATK 539

Order No. 347 of Form S-E received at Surf instructed us to wait at Concepcion until 12:01 P.M. for the beet Extra 9280 West and, to the east, at Gaviota until 12:15 P.M. for that train. Both times were now long past and the S-E "Time Order" no longer restricted us. We were now free to go as far as West Santa Barbara, the beginning of 3.4 miles of double track. Order No. 331 received at San Luis Obispo was still in effect. This Form S-C "Right Over Opposing Train" order still gave Extra 9280 West right over No. 832 from Burbank Jct. to East Santa Barbara. Because no section of 832 was specified, the order applied to all, including our First 832, as everyone knew.

Fig. 9. Our head brakeman stood across the main track to give a roll-by inspection to No. 13.

SAW BY AT MOORPARK

Out of Concepcion our OALAT, running as First 832, continued along the serpentine, now more gently ascending and descending Coast Line. At three locations between that station and Goleta, we had train-order restrictions on our timetable-authorized speed. Goleta was four major stations, those listed in the schedule column of a timetable (as in Fig. 2), and 37.5 miles to the east of us on our schedule. Stations designated as "additional," that is minor, ones are

listed in a special box in the timetable (see Fig. 3). Minor stations often have a only a spur or a storage track.

We had a number of interrelated directives for determining our speed. Speed is read from a speedometer in the engineer's workspace, which he checks at the beginning of a run with his watch and the passing mile posts: the Speed table on the back cover of our operating timetable informs, for example, that a mile in 1 minute and 5 seconds is 55.4 mph. Our permissible speed was given in LADT, pages 37-38, Special Instructions Santa Barbara Subdivision and on LADT, pages 27-31, Special Instructions All Subdivisions. The latter segment of pages informed us of the maximum authorized speed for our particular locomotive units (70 mph) and whether or not any of the cars on our consist list were in some way restricted and, therefore, must be operated with reference to a specified maximum speed. We had no such cars. The former segment of pages gave us the train speeds all along the Santa Barbara Subdivision. There were 77 different changes in speeds between San Luis Obispo and Los Angeles, depending upon the alignment and other physical characteristics and the operating conditions of any particular part of the route. Seventy-seven speed changes were listed both in a "column 1," for passenger trains and for freight trains authorized by train order to move at (higher) column-1 speeds but not exceeding 65 mph, and in a column 2, for other freight trains. Because we were issued no train order authorizing column-1 speeds, we necessarily observed the 77 slower speed changes in column 2 of page 37 of LADT, but not exceeding 55 mph. Freight trains with a K-suffix (denotes one or more loads of hazardous material) in their alphabetic designation, for example, the ordinary OAWCY redesignated as an OAWCK, run at still slower assigned speeds.

The all-important operating timetable must be changed from time to time to reflect alterations in physical and operating conditions. A new timetable of a new number and date is then issued. A Form Q "Issuance of New Timetable" order is issued, as per BOR 4-A: "During a period commencing twenty-four hours before and continuing until six days after it becomes effective, notice by train order, Form Q, must be given to conductors and engineers of trains." Thus, when our present LADT No. 10 was to be put in effect, a Form Q was issued:

LOS ANGELES DIVISION TIMETABLE
NO 10 IS EFFECTIVE 1201 AM APR 30TH

The three previously mentioned restrictions on our authorized timetable column-2 speeds were directed by Form X "Track Conditions Other than Form Y" order No. 1948, received by us at San Luis Obispo and addressed to all eastward trains as follows:

DO NOT EXCEED 40 MPH
BETWEEN MP 329.97 AND MP 330.33
BETWEEN CONCEPCION AND SACATE
DO NOT EXCEED 20 MPH
BETWEEN MP 335.1 AND MP 335.8
BETWEEN SACATE AND GAVIOTA
DO NOT EXCEED 45 MPH AT MP 355.5
BETWEEN CAPITAN AND GOLETA

The dispatcher must issue promptly track orders of these kinds, as soon as he receives either information or instruction to issue such orders. Information could come to him at any moment from the field, for example, from the foreman of a track gang, a signal maintainer, or a train crewmember. All manner of conditions can be anticipated with Form X. In deserts, the dispatcher could caution: "BETWEEN ABLE AND BRAVO LOOKOUT FOR BLOWING SAND ACROSS TRACK." And along our Coast Line he might warn: "HEAVY RAINS REPORTED BETWEEN FOX AND GEORGE/LOOKOUT FOR WASHOUTS AND SLIDES WHERE LIKELY TO OCCUR/LOSE TIME IF NECESSARY TO INSURE SAFETY." With such a Form X order in effect, the dispatcher must prepare for changes in his schedules and meets, and "rails" must add a new temporal filter to their calculations of T and TO operations.

Certain conditions require using a Form Y "Conditional Stop Sign Order." These are preprinted on a standard train order blank and the order headings are filled in as well as the station name, times, and mile post locations in the body of the order. Form Y is used in conjunction with BOR 10-1, the reference charts on pages 38-40 of the BOR, and the handy instructions on the back cover of the LADT (next to the Speed Table). An example of a Form Y order, used on the Mojave subdivision of the Los Angeles Division is as follows:

DO NOT EXCEED RESTRICTED SPEED BETWEEN MP 468.2
AND MP 469.2 BETWEEN HILAND AND CANYON
FROM 801 AM UNTIL 130 PM JUNE 27TH AND BE
PREPARED TO STOP SHORT OF UNATTENDED RED CONDITIONAL
STOP SIGN DISPLAYED IN VICINITY OF MP 468 FOR
EASTWARD TRAINS AND MP 469.4 FOR WESTWARD
TRAINS UNLESS ORALLY AUTHORIZED TO PROCEED
BEYOND THE STOP SIGN BY FOREMAN IN CHARGE OF WORK
OR A PROCEED SIGNAL WITH GREEN FLAG OR LIGHT IS RECEIVED
RESTRICTED SPEED MUST NOT BE EXCEEDED UNLESS
FOREMAN ORALLY AUTHORIZES A DIFFERENT SPEED
YELLOW PROCEED PREPARED TO STOP SIGNS ARE DISPLAYED
TWO MILES IN ADVANCE OF RED CONDITIONAL STOP SIGNS

A dispatcher uses a separate train-order book for Forms X and Y orders. Track orders are consolidated as often as practicable by the dispatcher to avoid delivery of numerous train orders blanks. For example, in the Order No. 1948 just mentioned, three Form X are combined on one order blank. Track orders must be reissued with a new order number on the first day of each month and thereafter at intervals not to exceed seven days. Train orders pertaining to track conditions and Form D-S orders are the only ones that may be written by the dispatcher prior to transmission.

During the winter of 1977-78, a savage Pacific storm hit the Coast Line and stretches of track on ocean cliffs were washed away or undermined. Sacate, the major station at mile post 334.8 had its main track compromised, thus, it had to be reconstructed through the location of the former 5164-foot siding. Proud Sacate of the tempestuous cliffs was transformed, thereby, into a minor station; in this instance, a location with a timetable name and its station

number (13850), but no facility beside the main track. For such conditions and for more ordinary operating situations, a dispatcher can hold all trains at a station, with a Form J "Holding Order": "HOLD ALL TRAINS." At times, he might want to hold a particular train: "HOLD EXTRA 5555 WEST."

Sometimes it is necessary to do extensive maintenance on one of a pair of double tracks (not two main tracks). In such cases, the second of the pair can be temporarily used as single track, on which trains are operated in both directions, by use of Form D-S "Providing for the Use of a Section of Double Track as Single Track." For example, this could have been the case on the 3.4 miles of double track we were about to traverse around Santa Barbara. An example of a Form D-S order used west of Sandcut station on the Bakersfield Subdivision of the Los Angeles Division is as follows:

BETWEEN 601 AM AND 101 PM EXCEPT SATURDAY AND
SUNDAY WESTWARD MAIN TRACK BETWEEN SANDCUT MP 325 AND
BLOCK SIGNAL 3151 MP 315.1 WILL BE OUT OF SERVICE
EASTWARD MAIN TRACK WILL BE USED FOR EASTWARD AND WESTWARD
TRAIN MOVEMENT BETWEEN THESE POINTS AND WILL BE UNDER CONTROL
OF FLAGMAN LOCATED AT MP 315 AND TRAIN DISPATCHER AT MP 325
EASTWARD TRAINS MUST NOT PASS MP 315 UNLESS PROCEED SIGNAL WITH
GREEN FLAG OR GREEN LIGHT OR ORAL AUTHORIZATION RECEIVED FROM
FLAGMAN LOCATED AT THIS POINT WHICH WILL BE AUTHORITY TO PROCEED
WESTWARD TRAINS MUST NOT PASS ABSOLUTE SIGNAL MP 325 UNLESS
AUTHORIZED BY TRAIN DISPATCHER UNDER PROVISIONS OF RULE 776
WHICH WILL BE AUTHORITY TO PROCEED AGAINST THE CURRENT OF
TRAFFIC TO MP 315.1 AT RESTRICTED SPEED WHERE CROSSOVER WILL BE
LINED FOR WESTWARD MAIN TRACK
MOVEMENT THROUGH ANY INTERMEDIATE CROSSOVER MUST NOT BE MADE WITHOUT
FIRST OBTAINING AUTHORITY FROM FLAGMAN AT MP 315 AND TRAIN DISPATCHER

An operator duplicated this order from an original on a photocopying machine. Therefore, in accordance with BOR 209, the copying operator had to sign his name on all duplicated copies below the name of the operator appearing on the original. Otherwise, the order would be unacceptable to crews in the field. Rule 776 has 50 lines of directives.

Our train rolled toward Gaviota along the coast and first reduced speed and then accelerated after traversing each of the locations of the three speed restrictions of the Form X order. These three stretches of restricted track would be worked upon by maintenance-of-way forces until returned to condition for normal timetable speeds. During the maintenance, a Form H "Work Extras" order would be issued by the dispatcher. A work extra, as crews analyze in their movements, is any extra train authorized by Form H order, the movement of which may be in either direction within specified territorial limits. Such extras may be for maintenance or construction of right-of-way, and also may be

a local freight engaged in the switching and spotting of cars for customers. An ordinary extra train is authorized by a Form G "Extras" order. Such a train may be used as a work extra for a short period. Then, its Form G train-movement order is annulled by order prior to issuing a Form H order to it.

Unless otherwise provided, work extras, whether standing or moving, must (flag) protect themselves in both directions, by Rule 99 or 99-A, against extra trains within the work limits specified in the Form H order. And time of regular trains must be cleared. The dispatcher makes the space of the work limits as short as practicable and changes them as required by the work. Work extras must give way to all trains as promptly as practicable.

A crew operating a train into the work limits of a work extra might have little to do in the way of manual labor, but the mental analyses can be weighty. To err in these analyses could mean running one's train over an unsuspecting track gang (roadway workers) or a place where the rails are temporarily removed from the track. When an extra train is run into the work limits of a work extra, it must be given a copy of the Form H work order authorizing the work extra, as well as any other Form H orders pertaining to the movement of the extra train into work limits. The exception to this is unless safeguards are made as prescribed by Form H, Examples (5) or (7). In these two examples the work extra is, respectively, ordered to clear, or not pass a particular extra. Should the work order instruct the work extra not to (flag) protect against extra trains in one or both directions, then the extra trains in direction or directions in which work extra is not protecting must not enter the work limits. The exception to this is when an extra train has a Form G, Example (6) authorizing it to run extra leaving named stations at specified times "WITH RIGHT OVER ALL TRAINS." Logically, however, the dispatcher must not issue a Form G, Example (6) while an order Form H, Example (12) is in effect--where a work extra "HAS RIGHT OVER ALL TRAINS" between named stations at specified times. The underlying assumption by all concerned is: two trains cannot have right over all trains for the same space and time. When a work extra is required to clear other trains, it must do so under the provisions of Rules 86 or 87 for clearing the main track.

Had a work extra been repairing some of the restricted track, we could have received a Form H order as follows:

ENG 2626 WORKS EXTRA 801 AM
JUNE 17TH UNTIL 1201 PM BETWEEN
GAVIOTA AND CAPITAN

This Form H creates engine 2626 as a work extra. No direction is specified for a work extra because it may move in either direction, in this instance--after leaving Gaviota. As the "rails" know, a work extra authorized between two stations has no authority to use the main track between the switches of the sidings at either station. It must enter the main track at initial switch, or point where time applies, as per Rule 5. Work limits and time limits must never be extended by supersedure (by Form P). For any extension, the original Form H order must be annulled and a new work order issued. Both the dispatchers and operators and the engineers and trainmen know this just as they know that the times in an order (as just listed) must not be given in an even hour designation.

If the dispatcher wants to authorize a work extra (a) to occupy the main track without flag protection against extra

trains in one or both directions or (b) to occupy main track while providing flag protection against the time of certain regular trains, the Form H order is modified, respectively:

- (a) NOT PROTECTING AGAINST WESTWARD EXTRA TRAINS
- (b) PROTECTS AGAINST FIRST CLASS TRAINS

With addition (a), Work Extra 2626 may occupy the main line without flag protection against westward extra trains. With addition (b) the work extra may occupy the main line under flag protection on the time of first class trains, shown on timetable schedule and as modified by train order. Second class regular trains are not mentioned in addition (b); therefore, logically, the work extra must clear the time of all such trains. Not only must the members of a crew understand the applicable rules set and act correctly upon information such as that just presented when they are on a work train, but also when they are operating any train approaching a work train.

Continuing our progress beyond the three stretches of restricted track, our OALAT reached the minor station of Ellwood, where the Ellwood local, manned solely by San Joaquin crews, is sometimes met.

Ellwood station is of historical interest in two ways. The Coast Line, with its own Coast seniority district for the various railroad crafts, built southward from San Francisco to this point, reaching Ellwood in 1901. There the Coast Line connected to the Santa Paula Line out of Saugus--branching from the Bakersfield to Los Angeles Line, completed in 1876--of the San Joaquin seniority district. After "tradeoffs," the boundary between the Coast and San Joaquin seniority districts was relocated at Santa Barbara, then a terminal. The former seniority district, henceforth, became San Francisco south to Santa Barbara, and the latter became Fresno south to Los Angeles and then north to Santa Barbara. On February 23, 1942 at Ellwood, the sole Japanese direct attack on the contiguous forty-eight states occurred when a submarine shelled a petroleum facility and associated railroad tracks. It was for a genuine threat, then, that the engines on the Coast had shrouded headlights during the war.

After Ellwood, we ascended out of Goleta and neared the beginning of double track at West Santa Barbara. Nearing Santa Barbara proper on the eastward of the double track, we saw a red train-order signal across from the architecturally superb, mission revival depot. The building was in a setting of palms and a magnificent, huge pepper tree. Opposite the depot on the westward main track, to our left as we approached, was the engine of the disabled beet train, Extra 9280 West. Its crew rolled us by from the depot platform and informed us that their train was in the tracks of the Santa Barbara yard. Its marker burned red on its caboose. Even though we finally "met" the Extra West on double track, we were required by rule to identify it just as if we had met it on Rule-S-71 single track. We had already deliberated: if this Extra West was not met with its marker, we could not go beyond the end of double track at East Santa Barbara.

Leaving East Santa Barbara through the spring switch onto single track, we headed eastward along the now brilliantly sunny coast. Around Montalvo station our timetable schedule informed us the block signals were no longer of the ordinary Automatic Block System (ABS) but one of Absolute Permissive Block (APB); therefore, BOR 740, 741, 744, and 745 obtained. At Montalvo, the important Santa Paula Branch joined our Coast Line. If the Coast Line were

blocked for some reason between Montalvo to Los Angeles, with proper orders, trains could be diverted over the Santa Paula and Saugus routes via Burbank Jct. into the city. The LATD cautioned, however, in its "Miscellaneous" Rule 1, on page 36, that all six-axle engines, including our two units, could not traverse the Santa Paula route.

According to Rule 740, on portions of the railroad within limits designated in the timetable as Absolute Permissive Block (APB), movements may be made without requiring train-order authority. Trains will then be governed by block signals whose indications will supersede the superiority of trains for opposing and following movements on the same track. Thus, a dispatcher can modify a superiority by timetable schedule and train order in the APB territory of Montalvo, as it also can be done in CTC, Rule-251, and Interlocking territories. The Oxnard operator places into operation the APB from Montalvo to Oxnard, when so directed by the dispatcher. The Espee originally installed this APB system of rail traffic control to eliminate a need for the handling of a large number of train orders and clearances. These were formerly required for the many local perishable movements originating on the Santa Paula Line and going to Oxnard yard for pick ups of refrigerator cars by through trains to Los Angeles and Oakland.

Fig. 10. Opposite the depot on the westward main track was the engine 9280 of the disabled beet train. Its crew rolled us by from the depot platform and informed us that their train was in the tracks of the Santa Barbara yard.

Train orders given to us with a clearance by the operator at Santa Barbara consisted of three Form X track orders and one Form S-C running order, No. 352, addressed to First 832 and Second 832, 834, and 836:

EXTRA 9040 WEST HAS RIGHT OVER
 FIRST 832 ENG 8498 BURBANK JCT TO OXNARD
 RIGHT OVER
 SECOND 832 ENG 7809 BURBANK JCT TO EAST SANTA BARBARA
 RIGHT OVER
 NO 834 AND NO 836 BURBANK JCT TO EAST SAN LUIS OBISPO

One of the three Form X orders informed us:

SIDING OXNARD BLOCKED WITH CARS

Thus the Form S-C "Right Over Opposing Train" order kept us from proceeding past the main track at the east switch of Oxnard siding for Extra 9040 West. We, however, could not logically expect it to meet us there and have to take siding as required by rule because the Form X removed the siding from use. But the extra's crew could switch it onto the tracks of Oxnard yard and meet us in that way. One of the extra's crewmembers must so informed us, however.

We should note in our Form S-C order that by now the dispatcher had authorized the second section (Second 832) of our schedule for which we carried green signals and whistled signal 14(k) (- o o) to trains and engines that we met or passed. He mentioned "Second 832, Engine 7809," which was now proceeding eastward out of San Luis Obispo. Today, it would carry no green signals for a following third section. Thus, the next following eastward train

mentioned in the order was No. 834.” By the time it was ready to be run, the dispatcher would have its identifying engine number and would have decided whether or not it would carry green signals for a second section.

Had the dispatcher wanted to modify our S-C order he could do so by issuing a Form P “Superseding an Order or Part of an Order.” For example, on a subsequent day he did so when he issued an order for June 27:

EXTRA 8418 WEST HAS RIGHT OVER
FIRST 832 ENG 8966 BURBANK JCT TO WALDORF
INSTEAD OF EAST SAN LUIS OBISPO

The operative words here in a Form P are “INSTEAD OF.” Thus, all concerned interpret that a previously issued order is superseded and no longer in effect. Without these two words, no order can be superseded. First 832 of June 27 now no longer must wait at West San Luis Obispo for the extra, as instructed by a previous order. Instead, it can go as far as the east siding switch at Waldorf, while “holding the main [line].”

As “rails” would caution, superseding must not in any way be confused with annulling. To them, the former word means “replacing/supplanting” whereas the latter means “nullifying/destroying the force of.” We have already explained Form L “Annulling Order” and Form M “Annulling Part of an Order.” Not yet mentioned is Form K “Annulling a Schedule or Section.” In this form, the schedule or section annulled becomes void between the points named and by rule cannot be restored for the specified date, either by another train order or by annulling the annulment order. An example of an “Annulling a Schedule or Section” order of Form K, used on the Mojave Subdivision of the Los Angeles Division is as follows:

NO 365 AND NO 375 OF JULY 9TH ARE ANNULLED DAYTON AVE TOWER TO MOJAVE
NO 340 OF JULY 10TH IS ANNULLED MOJAVE TO DAYTON AVE TOWER

These first class freight trains numbered in the 300s, have schedules beginning or ending at the easternmost extent of the double track at Dayton Avenue, interlocking, Tower. This is because by rule no superiority of trains exists in interlocking limits. Accordingly, railroaders justify, no train order can be issued to control the movement of trains in such limits. Interlocking, or “plant,” limits extend on the two main tracks eastward from this tower to and beyond the destination and origination point of these trains at Los Angeles Transportation Center. The interlocking control machine, usually housed in a track-side tower or depot, is used to regulate wayside color light or semaphore signals, track switches and any derails, and routes within the controlled limits. Home interlocking signals (capable of displaying a red indication) have no number or letter plate on their masts. The indications of a mast-mounted signal aspect anywhere on a railroad differ according to the significance of the various kinds of (or lack of) alphanumeric plates and auxiliary lights attached to them.

As railroaders have learned, a signal indication is the information conveyed by the aspect of a signal. A signal aspect is the appearance of a fixed signal conveying information as viewed from an approaching train, or the appearance of a cab signal conveying an indication as viewed by an observer in the cab. A signal also has a name, a

unique label. For example, per Rule 279, an aspect that is a green color-light signal on a mast bearing a plate with the letter D has the name DISTANT SIGNAL CLEAR and an indication of PROCEED. "The most restrictive aspect which can be displayed by a Distant Signal is yellow." The indication, per Rule 280, of a Distant (D-plate) Signal with a yellow color light is: PROCEED PREPARED TO STOP SHORT OF NEXT BLOCK SIGNAL. TRAINS EXCEEDING 40 MPH IMMEDIATELY REDUCE TO THAT SPEED.

At times a dispatcher does not wish to annul the schedule of a train, but does find it is delayed and will impede the progress of a train in the same direction. In that instance, a Form B "Directing a Train to Pass or Run Ahead of Another Train" order provides the exact degree of change in movement needed. For example, No. 832 of June 29th received a Form B "run ahead" order at Guadalupe addressed to No. 12 and No. 832:

NO 832 ENG 9198 RUN AHEAD OF NO 12 ENG ATK 572
GUADALUPE TO SURF

At Surf, No. 832 received a clearance with an attached written message, not a train order, addressed to the conductor and engineer:

"C&E NO 832 AT SURF":

FOLLOW NO 12 FROM SURF

The message does not have the authority of a train order but is, nevertheless, a written instruction from the dispatcher. An example of Form B "pass" order from the Mojave Subdivision, between second and first class freight trains No. 521 and 375 is as follows:

SECOND 521 ENG 8369 RUN AHEAD OF SECOND 375
ENG 9310 PALMDALE TO EAST MOJAVE

Our First 832 roared through the yellowing late afternoon on down the coast toward Oxnard, a train order station, 4.6 miles to the east of Montalvo. As we ran along the main track parallel to Oxnard siding, we could see the reason for the Form X order saying the siding was blocked. An engine, 3430, coupled to a number of cars and a caboose, but not in service as a train, and then a separate long cut of cars were temporarily stored on the siding and the siding extension.

Fig. 11. An engine, 3430, coupled to a number of cars and a caboose, but not in service as a train, was temporarily stored on the siding extension.

At Oxnard depot, the train-order signal was red. From the train-order delivery fork, we snagged on the fly a clearance with one running order. If the order had continued to restrict us at Oxnard as had our previous Form S-C "Right Over" order against Extra 9040 West, it would not have been mounted on the delivery post next to the train order signal. Having seen no orders on the delivery mast, we would thus have had to stop for a clearance before we could continue past the station. As all concerned knew, in this way the dispatcher would have the Oxnard operator deliver an order to us restricting our movement beyond that station. To restrict us, the Oxnard train-order and control

operator would have remained in his depot with our orders. But in this instance, because of the visible presence of the paper clearance in the cord on the delivery post, we did not have to stop at the red signal: instead, its aspect indicated proceed (BOR 221). Although its aspect was indeed red, with these considerations, this signal did not indicate "stop" to us. With no visible paper on the delivery post, the red aspect would have indicated "stop" to us. The post is illuminated with a light by night, to help crewmembers in making this safety-critical determination.

Our new running order received at Oxnard was a Form S-E "Time Order" reading:

EXTRA 9040 WEST WAIT AT
SANTA SUSANA UNTIL 401 PM
MOORPARK 415 PM
CAMARILLO 425 PM
FOR FIRST 832 ENG 8498

Oxnard is 53 feet above sea level. The crest of the Santa Susana pass, 33 miles to the east just beyond the station by that name, is 1127 feet above sea level. Out of Oxnard, we climbed steadily up the 1 percent eastward grade. Roaring upgrade at full throttle but with only a moderate speed, we could reach Moorpark just before 4:00 P.M. Because Extra 9040 was due out of Santa Susana at 4:01 P.M., we would have to meet it at Moorpark. Rule 86 said that we had to clear the main track before the leaving time of the opposing superior train. Thus, we could not possibly be in the clear at "Santa Sue" siding before 4:01 P.M.

The opposing Extra West was superior by right to our otherwise superior second-class train by virtue of the Form S-C "Right Over" order received at Santa Barbara. This order gave the extra right over us up to Oxnard, now to our rear (west), but a right now mitigated by the time order delivered at Oxnard. Thus our crew's mental plan for action was based upon the superiority of our train over all save first class trains (and, logically, westbound second class trains, but which were not found on our route). After these considerations of class and direction of trains, we reflect upon the higher, train-order-given S-C, right of the Extra West against us and, then, the train-order-directed S-E restriction of this right. Railroaders learn the hierarchical sequence of application of directives for their work.

At the west switch of Moorpark siding, First 832 stopped at the block signal bearing number plate 426.4. Our head brakeman threw the switch to line us eastbound into the siding. Block signals are designated by numbers indicating approximately the distance from a major terminal, such as San Francisco, in miles and tenths of miles according to mile posts; signals governing eastward trains have even numbers and signals governing westward trains have odd ones. Hence, the block signal was for eastward movements and near mile post 426. This sequence of numbers from San Francisco for mile posts and block signals increases to mile 1620.4 at Tucumcari, New Mexico. There and at El Paso new sequences of miles begin. Our train was 5161 feet long and the timetable showed Moorpark siding to be only 4912 feet long. We pulled up eastward as far as we could into the siding, but our rear end--several cars and the caboose--necessarily stuck out of the passing track through the west switch onto the main line. What now? We would have to "saw by" at Moorpark.

Fig. 12. At the west switch of Moorpark siding, First 832 stopped at the block signal bearing number plate 426.4. Our head brakeman threw the switch to line us eastbound into the siding.

Fig. 13. Extra 9040 West slowly approached the east end of Moorpark at 4:20 P.M. in response to the restricting block signals.

At the east end of the siding the westward block signal showed yellow, and the following westward signal protecting the west end siding switch would show red. Extra 9040 West had "showed her color" and approached the east end of Moorpark at 4:20 P.M. at a slow speed in response to the restricting block signals. We whistled to the extra that we carried green signals (- o o) and it replied (o o). The extra stopped before the red, west end, westward signal. Its rear end had cleared the east siding switch from which we most exit. Impeding its progress was our train, hanging out of the siding onto the main track beyond the protection of the red block signal. Our First 832 proceeded eastward from the siding out onto the main track, thereby pulling the rear of our train off the single-track main line to the west and into the clear onto the siding. After the west end switch was realigned for the main track, the west end signal then changed from red to green. The two trains had sawed by at a siding too short for one of them. As our "hoghead" explained, when a siding is too short for both trains, then the crew gets into mental problems of car handling. In such a circumstance, parts of trains must be switched onto adjacent short spur tracks, in accordance with the number and capacity of spurs at that station.

Leaving Moorpark, we continued upgrade and, near the crest, entered a tunnel of about a mile and one-half long. We could not immediately see the light at the end of the tunnel because the summit was at mid-tunnel and, first, we had to begin our descent. As we crested the summit, our "hoghead" began his changeover from power throttle to dynamic (electrical) braking, taking care first to let the amperage decay in his 12 electric traction motors and then to gather the slack gently as he went from a stretched to a tightly bunched mile-long train of expensive merchandise. Beyond the crest of the grade, we went through another tunnel just before a sharp right-hand curve. The green block signal at the mouth of the tunnel protected our otherwise blind movement into the obscured mountain curve. We were now rolling down through the striking craggy and rocky cinemascap, familiar around the world from the countless Westerns filmed in this area. At around mile post 448 just to the east of Chatsworth station on the downgrade into Burbank Jct., we were in full dynamic braking as our engineer controlled the descent of our trailer train. After an engineer converts his propulsive, electric traction motors to generators, the dynamic brake takes the load off the air brakes or obviates the need for such brakes. A dynamic brake is a locomotive braking system using electrical means to convert some of the downgrade momentum of the locomotive into current, dissipated as heat through roof-mounted grids and cooling fans. This brake thereby provides a retarding force within certain upper and lower speed limits regulated by the engineer. If the train had been heavier or the dynamics not as effective, he would have minimally reduced the air pressure in the brake pipe running the length of the train from 90 to 84 psi, putting 15 psi into the brake cylinders of all 56 of our trailing cars. We rolled along at 55 mph from Chatsworth, past Gemco with its huge General Motors Corporation assembly plant for autos, past Hewitt, to Burbank Jct. At any of these stations just

named the heavy lumber train coming down the Coast from Portland sets out a several-thousand ton block of lumber cars. Yard engines and local freight trains later spot these cars at lumberyards throughout the Los Angeles basin. Gemco is the destination of numerous carloads of parts for the assembly line, hauled in westbound priority one freights, usually having an A suffix.

Entering the interlocking limits at Burbank Jct. meant the joining of our Coast Line, at its last mile (462.7) with Saugus Line in its own mile sequence (at 471.6) of the San Joaquin Route, coming out of the Mojave Desert and the San Joaquin Valley. After lining us toward Los Angeles Yard with green, plateless, interlocking signals, the Burbank train-order and control operator stood outside his small metal building to give us a roll-by inspection, as required by the rules. We ran through Burbank on the eastbound of the now double-track main line into Los Angeles, past the former Burbank depot, now used by a business, at mile 472.1. Here a westbound train on the opposite track approached us--heading to the Mojave. Just west of Glendale station with its large passenger depot, at mile 477.1, we stopped and then proceeded past at restricted speed for each of two successive automatic block signals displaying red (BOR D-506, 507). Automatic block signals bear number plates (as opposed to other kinds of wayside fixed signals for rail traffic control which bear various kinds of alphabetic or no plates), govern a series of consecutive blocks (stretches) of track, and are actuated by rolling stock or certain other conditions, such as the throwing of a track switch. On the Espee nine kinds of fixed signals exist capable of a red aspect; the number-plate ABS signal was just one of these.

Fig. 14. On a trip westward to SLO, orders are snagged at Burbank Jct. from the post-mounted, train-order delivery fork.

Now we were in the area of the greater Los Angeles terminal, a bustling complex of interconnected lines and yards of a number of railroads. We rolled past Arroyo Jct., at mile 478.5, where a sometimes local freight of the Los Angeles and Salt Lake (LA&SL) turned off the Espee westbound main into its own remnant of a Glendale Branch. Up ahead, we could see, pulling slowly into Los Angeles Yard, the red marker light burning on the caboose of an Extra East out of the San Joaquin Valley. At 4:50 P.M., alongside the Los Angeles River, we had arrived outside of our next to final destination, the sprawling Taylor Yard with its Taylor engine facility. Augmenting older yards near the center of the city, the Espee constructed the first parts of Taylor in 1922-23 and built the Taylor Roundhouse, supplementing that at Alhambra Avenue, in 1929-31. In this summer of 1978 Taylor was quite busy, one of its Assistant Terminal Superintendents told me later in the day, while I observed the switching over the hump of a mile-long cut of cars from an inbound train. After making a set out in the yard of about the rearmost one-third of our train including the caboose, we exited the busy yard and ran downgrade on the double track along San Fernando Road.

In the limits of Dayton Avenue Tower, at mile 480.7, we began the final part of our run, governed continuously by interlocking signals, to our last station, the Los Angeles Transportation Center (LATC) at mile 482.9. The Dayton control operator could have run us "the long way around," across the Los Angeles River over the original single-track, River Station Line down the west bank of the river. (River Station was the location, no longer marked in a timetable, of

the original storefront depot--dating to 1884, engine facility, and yard complex of the Espee in Los Angeles.) Instead, the operator ran us directly down the east bank on the newer two main tracks signaled in both directions. As we moved eastward along the concrete-lined, waterless river, we went under the bridge crossing of our line by a Santa Fe single-track main from Los Angeles to the east. Beginning at this exact, bridged, point on our route, although still under the control of the operator in SP Dayton Avenue Tower, the right-of-way belonged to the LA&SL for all rest of the way downstream along the east bank. (Up to the 1960s, a demarcation post under the ATSF bridge so informed.) Immediately thereafter, we passed Glendale Jct., at mile 481.5. This is where the LA&SL's Pasadena Branch diverged, away from the riverbank. The junction is so named, on LA&SL property, because after 1939 the LA&SL's Glendale Branch was rerouted from this station along the Espee's two main tracks up river through Dayton Avenue and Arroyo Jct. (This was instead of diverging, as since the 1880s, from a few miles further along on the LA&SL Pasadena Branch.) Technically upon the LA&SL Pasadena Branch, comprising two interlocking, heavy main tracks controlled by the Espee, we rolled to our next station on this route. Just before East Bank Jct., mile 481.9, we were "handed off" by Dayton to the control operator at ATSF Mission Tower, who controls all of the lines around Los Angeles Union Passenger Terminal. From East Bank Jct., again on Espee right-of-way, we were lined--on one of three possible main routes--to the left through Taylor Jct., at mile 482.1, into our final terminus, LATC. This final station was actually on the Los Angeles end of the Sunset Route to Yuma-- and on to New Orleans. At LATC, we cut our engine away from the remaining cars of the OALAT and retraced our route, back up river through Dayton Avenue, where, by his (remote control) interlocking track switches, the operator lined our two units into the Taylor engine facility. There we tied down the engine, killed the two 3000 hp diesels, and registered off duty. As we headed off to "beans," it was after 6:30 P. M. Breakfast in paradise was ages ago, and I was famished in this smoggy, nonangelic town.

Soon, some of our tri-level-rack cars of new autos and the long flat cars with piggyback trailers and containers would be switched and unloaded in the Los Angeles terminal and others would be shunted into connecting outbound trains. First 832, the OALAT, of June 17 had fulfilled its schedule by arriving at Los Angeles Yard, the final station for this schedule. The engine and two thirds of the cars, minus caboose and marker, of the OALAT, however, ran from that station--as a yard movement entirely within yard limits. Our authority to move was yard-limit Rule 93. But by rule we also needed the permission of the yardmaster to leave his yard and enter the main track, and of the interlocking signal indications given to our engine 8498, with cars, by the Dayton and Mission control operators. Working logically by induction, deduction, and other reasoning in accordance with the interacting requirements of the book of operating rules, timetable schedule and special instructions, timetable bulletins, the directives of the clearances and many forms of train orders, signal indications, and oral instructions over the radio, the crewmembers of the Espee's First 832 of June 17 completed their run safely and effectively. And, by performing similar mental worktasks, so also would the crews of Second 832, following it several hours to the west, and of No. 834, just now departing from San Luis Obispo, with no signals displayed, in yet another "highballing with flimsies" down the Coast.

RUNNING EXTRA, LOSING SCHEDULE, AND OTHER CONSIDERATIONS

Our trip on First 832, allowed us to discuss T and TO work while thinking about and using most of the extant train-

order forms and many of the timetable considerations. A few important related matters must still be covered in order to complete the comprehensive examination of mental work of this kind. For example, what happens if a regular train is twelve hours behind its schedule and it loses authority to move on it? Further, just what is the nature of the authority for the movement of all of those extra trains opposing us on our just completed trip? After all, they are not classified in the timetable with a schedule.

Amounts of traffic fluctuate with seasonal and other business conditions, and schedules of certain trains must be changed for any number of traffic and operational considerations. These factors require, from time to time, changes in timetable schedules. When a new timetable is issued, flow of trains must be continued without interruption, and schedules fulfilled as far as practicable. Without such continuations, all trains authorized by the old timetable, the moment the new one took effect, would have to be run extra to their terminal stations by means of train-order authority. As authorized by Rule 4, if a schedule of a preceding (old) and new timetable correspond in seven ways, the train running on the old schedule can run on the new one.

Each operating timetable, from the moment it takes effect, supersedes the preceding one and its schedules take effect on any subdivision at the leaving time at their initial stations on the subdivision. When a schedule in the old timetable corresponds in seven ways with the schedule of the new timetable, and is in effect as prescribed by Rule 82 (not over 12 hours late), however, a train authorized by the preceding timetable will retain its train orders and assume schedule of the corresponding number in the new timetable. The correspondence in seven ways is regarding number, class, day of leaving, direction, route, initial station, and terminal station (BOR 4). For more on the seemingly unfathomable mental tasks concerning change of timetable see Forman 1904:33-52, 408; Collingwood 1909:12-18; Hoffman 1938; Matthews:1943,1:12-24. These books of instruction and discussion on operating rules make interesting advanced reading on the subject.

Timetable schedules, unless fulfilled, are in effect for twelve hours after their time at each station (BOR 82). What if a section of a schedule leaves its initial terminal several hours after the time of the schedule at that station, has considerable unanticipated switching and some delays along the way, and then finds itself twelve hours behind its scheduled time at a station en route? Second 834, engine UP (Union Pacific) 3002, eastbound out of San Luis Obispo with no signals for a following third section on June 25 provides a good example of what happens. It left San Luis Obispo at 9:05 P.M. The time at that station for schedule No. 834 was 3:00 P.M. (Schedule 836 could not operate until 10:00 P.M.) A number of S-C "Right Over Opposing Train," S-A "Fixed Meeting Points" and other orders were issued to Second 834 for its eastward run from San Luis Obispo.

At Oxnard, Second 834, engine UP 3002, received a Form S-A order directing it to take siding and meet Extra 8312 West at Santa Susana. The time shown for schedule number 834 at Santa Susana station was 6:28 P.M. The A.M. counterpart of this time, 6:28 A.M. or 12 hours later, came while Second 834 sat there in the siding waiting for its, subsequently delayed, meet. Once that time of 6:28 A.M. was past, schedule 834 was no longer in effect and regular train Second. 834 lost both its schedule and train-order authorities. In short, as its crew and others

determined in the logic of the rules, train Second 834 of June 25 no longer existed. All rights of the train were void, irrevocably. Engine UP 3002, about 80 freight cars and a caboose (with an extinguished marker light) sat on Santa Susana siding, but no longer constituted a train. Speaking of mental worktasks, just before and just after the twelfth hour the physical reality of engine UP 3002 and its freight cars and caboose had not changed one iota, except for the illumination of the marker light. Conceptually, however, what had been a train to everyone working on the Coast Line was now no longer a train. Philosophers in the Middle Ages would have loved to contemplate how many trains could dance on the duration of a schedule. Like Cinderella's wondrous coach, Second 834 had turned into a pumpkin when the last minute of the twelfth hour passed. Now the rolling stock in the siding could only proceed as authorized by Rules D-97, 605, 740, or 760. These rules, however, applied to kinds of operating territories other than the S-71, T and TO territory around Santa Susana. Further, Santa Susana was a blind siding, that is, it had no train-order office. The Espee removed its depot with train-order office from service some years previously.

The rolling stock of former Second 834 had no authority to occupy the main track but was safely tucked away, hence protected, off the main track by the dispatcher's S-A order. Meanwhile, at Burbank Jct., Extra 8312 West received a Form G "Extras" order for it, authorizing that train to run extra to San Luis Obispo. It also received another Form G, addressed to the C&E of "ENG UP 3002 AT SANTA SUSANA CARE ENGINEER EXTRA 8321 WEST," reading:

AFTER EXTRA 8312 WEST ARRIVES SANTA SUSANA
 ENG UP 3002 RUN EXTRA
 SANTA SUSANA TO BURBANK JCT.
 THIS ORDER ANNULLED AT 905 A.M.
 COMPLETED 545 A.M.

The order was addressed to "ENG UP 3002" because an engine, and not a train, was all that existed at Santa Susana, according to the rules. Upon receipt of the Form G order, the Union Pacific engine was authorized to run as an extra train, but not after 9:05 A.M. when the Form L "Annulling Order" took effect. As the crew knew, the dispatcher had a good reason for this Form L "stinger." This reason relates to the federal Hours of [railroad] Service Law, but, in this monograph, we cannot cover all the bodies of information for crew judgement and planning for work acts.

When conditions permit, and the dispatcher feels that a regular train will become more than twelve hours late on its schedule at any time, the schedule or section of a schedule is annulled, with a Form K order. The train is then authorized with other authority, for example, a Form G order to run extra. Or, with a Form F order "For Sections and Authorizing Regular Train at Intermediate Station," after taking a number of required precautions, the "delayer" could have authorized the engine to run on the authority of the following schedule, No. 836. Thus the dispatcher could have given authority to UP 3002 to run as First 836 and changed the following 836 to Second 836.

By now, the reader realizes that a numbered schedule in an operating timetable does not represent a particular physical train that moves between initial and final stations on that schedule. It is, instead, an operational convention--an arbitrary numbered designation of sequential times at named locations across a territory. With such a designation,

any rolling equipment defined by rules as a train may be operated as one entity or in two or more sections. Of course, the schedule may not be operated, that is, annulled.

An extra train is not always authorized by a Form G order, or Form H if a work extra. It depends upon the territory involved. Orders are not used to run extra in CTC and Interlocking territories. Rule 82-A instructs, however, that when its initial station is an open train-order office, unless otherwise provided, such an extra train must not leave without a clearance bearing OK time and initials of the chief train dispatcher. Rule D-97 refers to Rule 82-A and further instructs that when authorized by timetable, trains moving with the current of traffic on double track may run extra without train-order authority. LADT Special Instructions, Santa Barbara Subdivision, page 33, say that this Rule D-97 will apply at a number of locations including: "Between Burbank MP 473.28 and Los Angeles MP 479.31," which is double track.

The LAOAK of June 26 ran as Extra 8773 West to San Luis Obispo from Los Angeles Yard and is instructive for us. BOR 816, 827, 827-A, 834, 837-A, 838, and 868 directly govern movement of its K (hazardous) loads, as do other rules in the timetable's special instructions. Yet other instructions regulate the specially designated speeds of K trains. At Los Angeles Yard, the operator on duty in the yard office gave the C&E of engine 8773 a clearance authorizing it to run as Extra 8773 West. This authority was valid only to Burbank Jct., the end of the stretch of Rule-D-97 territory. The operator listed no orders on the clearance, and none were required on this double track. As required, he attached a message to the effect that the extra was 4676 feet long.

From the operator at Burbank Jct., in the small interlocking building replacing a tower demolished by a derailment, the Extra West received a clearance, with seven running and three track orders, plus a message. The message stated that opposing, eastbound, "First 832 is 6016 feet and Second 832 is 4419 feet." Thus the Extra West will be prepared for a saw by meet at a number of stations. Meets will be difficult between the extra and First 832 at some stations. Extra 8773 West received a number of Form S-C and S-E orders at Burbank Jct. But most important, it received the vital Form G "Extras," without which its crew had no authority to proceed out of the Rule-D-97 territory ending at the Junction and into the Rule-S-71, T and TO, territory beyond it:

ENG 8773 RUN EXTRA
BURBANK JCT TO SAN LUIS OBISPO
THIS ORDER ANNULLED AT 1135 PM

Before the running order for the extra is made complete (in effect), logically, a dispatcher must finish some safety-critical mental tasks by providing protection for an extra in T and TO territory. Thus, before the Form G was issued, four S-C orders with prior (lower) order numbers were given to all trains affected. All four of these protective S-C orders and the extra-creating G order are delivered at the same time to the Extra 8773 West. Further, a dispatcher must not issue

running orders for an extra train short of its destination on a subdivision. Also, before running orders are issued for an extra, the train-order book and the train sheet must be checked by the dispatcher to assure that proper protection is provided against all opposing extra trains. One S-C "Right Over Opposing Train" order combined with a Form L

“Annulling Order” and addressed to all “Westward Extra Trains via Chatsworth” (that is, via the Coast Line), included this newly created Extra 8773 West and instructed:

EXTRA 8916 EAST HAS RIGHT OVER
WESTWARD EXTRA TRAINS
MOORPARK TO BURBANK JCT
THIS ORDER ANNULLED AT 530 PM

Thus Extra 8773 West was inferior by the train-order conferred right given to the opposing Extra East, and both would be governed accordingly. Because no times are given, logically, the Extra West must wait at the end of double track at Burbank Jct. until the Extra East arrives or until 5:30 P.M. Actually, the Extra East arrived at the Junction before the Extra West did. The dispatcher had, however, protected both extra movements by mentally organizing and then issuing proper orders to all trains involved in any possible interaction on the T and TO line between Burbank Jct. and San Luis Obispo.

For the same reason of providing protection by mental act rather than physically providing flag protection, the new Extra West also received an S-C order instructing it had “RIGHT OVER NO 834 AND NO 836 BURBANK JCT TO EAST SAN LUIS OBISPO.” This order protected the two eastward second class trains, including any sections of these, and the Extra West during their opposing movements. As we can see, in Rule-S-71 territory, train crews know that no inferior train can move against a superior train without a protective train order giving a right to this effect. The concerned crews then think and consequently plan and act accordingly. As their respective runs developed, the dispatcher would modify this “Right Over” order to allow one or more sections of the second class trains to progress eastward beyond their initial terminal. For now, any amount of potential sections of the second class trains were protected against the (unscheduled) Extra West as in BOR 218. “When a schedule is designated in a train order by its number alone, all trains operating as sections of that schedule are included, and each must have copies delivered to it.” Another S-C order gave the Extra West right over First 832 to Santa Susana and still another S-C combined with a Form S-E “Time Order” governed movement opposing Second 832, instructed to “WAIT AT” by the S-E order:

EXTRA 8773 WEST HAS RIGHT OVER SECOND 832 ENG 9210
BURBANK JCT TO SANTA SUSANA
SECOND 832 ENG 9210 WAIT AT
CAMARILLO UNTIL 459 PM
MOORPARK 610 PM FOR
EXTRA 8773 WEST

Combining the S-E with the S-C form gave the dispatcher greater flexibility in expeditiously advancing the extra against what he calculated would be the progress of the regular train. In doing so, he had to calculate the tonnages, amount of horsepower, and gradients involved

Should the dispatcher find the Extra 8773 West overtaking another Extra West, which was delayed because of work en route or difficulties, he had the advantage of using a Form D “Right Over Train in Same Direction Order” to

expedite the progress of the former train. With Form D, he could direct: "EXTRA 8773 WEST HAS RIGHT OVER EXTRA 8888 WEST SANTA SUSANA TO EAST SAN LUIS OBISPO." The first-named train has been established as the train of superior right between the named stations. Logically, because no time is given in this instance, the second-named train must not leave the first-named station ahead of the first-named train. The first train would thus pass the second.

To insure that the Extra 8773 West knew the status of opposing first and second class trains the dispatcher gave it a Form V "Check of Trains" order:

REGULAR TRAINS DUE BURBANK JCT ON SANTA
BARBARA SUBDIVISION BEFORE 330 PM JUNE 30TH HAVE
ARRIVED AND LEFT EXCEPT FIRST 832 ENG 8966
AND SECOND 832 ENG 9210

To the "rails," the word due means the timetable scheduled leaving time at the named station. If a Form V instructs that a section has arrived or left, say Third 830, then all preceding sections of the same schedule, 830, have arrived or left. Arrival or leaving of a section must state "WITH NO SIGNALS" or "WITH GREEN SIGNALS" as the case may be, so that the train crew receiving the Form V will be fully informed and protected with regard to any following sections.

A Form D-A "Passing Loads of Excess Width" order provides protection to the extra-wide loads that must be transported by rail. These might be large parts of aircraft, giant industrial retorts, and other immense structures. We find an example of a typical Form D-A from the Bakersfield Subdivision of the Los Angeles Division as follows:

EXTRA ATSF 5538 WEST HAS 4 CARS WITH LOADS 14 FEET
8 INCHES HIGH AND 12 FEET 6 INCHES WIDE
WHEN MOVING THROUGH YARDS RESTRICT AS FOLLOWS MEET NO LOADS OVER
12 FEET 6 INCHES WIDE WHEN ONE TRAIN STANDING AND 11 FEET 6 INCHES WIDE
WITH BOTH TRAINS MOVING AND 11 FEET WIDE ON CURVED TRACK
MEET NO LOADS OVER 11 FEET 6 INCHES WIDE ON DOUBLE TRACK
REDUCE SPEED TO 10 MPH THROUGH TUNNELS 17 16 14 AND 3
MEMBERS OF CREW MUST NOT RIDE ON THESE CARS AND YARDMASTERS
PERMISSION MUST BE OBTAINED BEFORE ENTERING YARD

Such an order provides for the movement of trains by one another in opposite directions on double track or multiple main tracks at locations and in the manner where track center lines provide sufficient clearance for the loads of excess width involved. Many variations of Form D-A orders exist to suit the particular circumstances. The above restriction of 10 mph through four tunnels is to prevent the train from inadvertently widening the bores with its wide loads.

Form Z "Signals Out of Service or Restored" orders provide for the removal or putting back into operation and the change of function of wayside automatic block and other signals. For example, an order addressed to "EASTWARD TRAINS VIA WASH," on the Colton Line of the Mojave Subdivision of the Los Angeles Division instructed for the vicinity of Bench station:

EFFECTIVE 801 AM JUNE 20TH AUTOMATIC BLOCK
SIGNAL 4880 BENCH WILL BE CONVERTED TO A DISTANT SIGNAL

Distant signals (covered by BOR 286, 99-A, and page 128) provide information only to govern the approach to a block signal. Again, they have a plate bearing the letter D and are incapable of displaying a red aspect.

Before ending our exposition on the mental T and TO work of railroaders, something further must be said about yard limits in relation to these operations. The rules define yard limits as:

"The territory between yard limit boards placed adjacent to main tracks to designate the points between which engines may operate on main track without train-order or timetable authority. The territory will be designated in timetable" (BOR, p. 22). (A number of rules pertain to operations in yard limits, especially 10-1, 89, 91, 93, 99, 101-A, D-161, Form D-S, 508, 834-A, and 842.)

Rule 842 stipulates the authority of yardmasters within yards and over trains, engines, and operating employees in yards. Rule 93, the basic one governing operations within yard limits--including main tracks, sidings, and other or yard tracks--reads in part:

"Within yard limits, ENGINES, after complying with provisions of Rules 81 or 81-A, may use main track without train-order authority, clearing the time approaching first class trains are due to leave the last preceding station where time is shown. Flag protection against trains and engines is not required." Rule 80 explains how trains and engines receive authority to occupy a main track and Rules 81 and 81-A prescribe the manner in which a train or engine may foul a main track. Trains must also comply with Rules 86 and 87 within yard limits just as they must outside of yard limits. These two rules prescribe the time and manner in which a train clears the main track for opposing and following superior trains.

In short, Rule 93 authorizes engines to occupy the main track within yard limits. The reason for the rule is to provide a stretch of main track, designated by wayside yard limit boards, where engines and trains may work without flag protecting against regular and extra trains and other engines. Yard limits, then, provide a zone in which many of the judgments we have been discussing in this monograph may be put aside, to facilitate the many yard movements onto and off the main track. But railroaders remember engines must clear the time of approaching first class trains in the manner prescribed by Rule 93.

Yard engines, those assigned to service in yard limits, receive authority to occupy the main track directly from the operating rules, especially Rule 93. Because, under the rules, a train dispatcher does not create the movement of a yard engine, he knows he cannot control its movement in T and TO territory. Thus, logically, he may not confer to a train an ordered right over a yard engine when he has no rule with which to take the Rule-93 authority away from the engine.

THINKING UNDER THE RULES AND TO OPERATIONS: A RETROSPECTION

This monograph on mental/cognitive skills and worktasks of railroaders has reviewed the highlights of rules and practices for railroad operations by train order and timetable and has given some exemplification. No other mode of transportation, not even commercial aviation, requires the ability of the vehicle operators and traffic controllers to learn, understand, manipulate, and correctly apply such a complex code of rules to constantly changing conditions for safe and efficient operations. These employees carry out their day-to-day, safety-critical tasks with understanding and judicious use of appropriate combinations of the interrelated rules. Such understanding and use is vitally important because direct supervision of operating employees is not possible in the mobile and dispersed activities of railroading. As railroad specialist and Railway Age editor John Armstrong notes (1978:219):

“Perhaps the single most important fact affecting the railroad organization, particularly in the transportation department, is that most of its employees must carry out their work away from their supervisor; yet the railroad is a system whose parts must all work together in precise timing. This high level of individual responsibility has made railroading a proud profession, and it has also meant that the limits of individual initiative in carrying out duties must be established by written rules.”

According to a monumental study Safety in the Railroad Industry by the Railroad Retirement Board, railroading is the very acme of close relationship between safety and industrial operations and railroad safety is grounded in the rules, including T and TO operations (RRB 1962:2-54):

“Because of the nature of the activity, safety is integrated with railroad operations . It is doubtful whether one could find many other industries where safety and operations are as inseparably joined as in the railroad industry. An error in a train order or a misunderstanding of an operating rule can result in a costly delay, but it can also result in a costly collision.”

In all, operating and connected railroaders’ mental work concerns an industrial process, movement of trains and engines, involving a potential risk, often of catastrophic dimensions. These dimensions ordinarily remain only a potential and are rarely actualized. (In its potential for catastrophic accident rarely realized, railroading is thus quite similar to commercial aviation.) Without intelligent, informed compliance with and application of the operating rules, railroad work cannot be conducted. Safety in railroad operations is absolutely grounded in and totally dependent upon mastery of knowledge and mental skills regarding the rules. Such mastery of demands of work allows railroaders to complete their necessarily not-directly-supervised operational tasks with precision and safety.

The safety-critical requisite of railroading is the railroaders’ mental skills, such as those in their T and TO work just discussed, necessary for responsible application of rules to ever-changing circumstances. Of course, that accident rates are infinitesimally low in T and TO and other, related rule-based railroad operations also attests to the high standards maintained in developing and enforcing the code of operating rules and in selecting, training, and testing employees in their use. These standards add to the occupational stature of operating and connected railroaders--industrial workers who are peerless in the mental responsibilities found in their everyday work.

Some years ago, a quite complex board game called “Dispatcher” appeared on the market. It took hours for the average person to learn the rules of the game so that he or she could even begin to play it. The game was a simplified version of some of what the reader has learned in this case study about railroaders’ mental work. Eventually, the manufacturer withdrew the game from sale. Many players said only railroaders could master it. Having read this microethnographic monograph, the reader appreciates the mental difficulty of “Dispatcher” play--and of the reality it models, T and TO and other railroad work.

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